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COYOTE CREEK: MONTAGUE EX. TO INTERSTATE 280 BASELINE FISHERIES HABITAT STUDY

Prepared for:

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A fishery habitat survey was implemented in the summer of 2006 to establish baseline conditions within the Santa Clara Valley Water District's (District) Coyote Creek Project reach. The survey was conducted from 500 feet downstream of Montague Expressway to 500 feet upstream of Interstate-280. This report provides survey locations, methodology, and study results. Data from this report will support planning of the Coyote Creek Project baseline fisheries study and other District activities within the watershed.

The objectives of this survey were to:

- Delineate habitat units using a modified protocol of the aquatic habitat classification system from the California Stream Habitat Restoration Manual (Flosi et al. 1998);
- Measure daily discharge prior to habitat typing;
- Evaluate instream habitat within each identified habitat unit, including cover complexity and cover amount;
- Evaluate the amount, type and quality of vegetation for each habitat unit;
- Assess spawning gravel for each appropriate habitat unit type.

Habitat within the surveyed reach was composed predominantly of pool habitat, with minimal amounts of run and low-gradient riffle habitat. Habitat units and the physical description (i.e. length, width, depth) of each type of habitat are described in detail in Table 3-1. Locations of aquatic habitat units and spawning gravel are depicted on Maps 3-1 through 3-13 and Maps 3-14 through 3-22, respectively.

1.0
INTRODUCTION

The Coyote Watershed is the largest watershed in the Santa Clara Basin, encompassing an area of over 320 square miles. The entire city of Milpitas and portions of San Jose and Morgan Hill lie within its boundaries, with the remaining area comprising unincorporated lands within Santa Clara County. The eastern and southern portions of the watershed are upland areas with elevations ranging up to 3,650 feet. These areas include the western face of the Diablo Mountain Range, a part of the Coast Ranges stretching along the Pacific coastline.

The creek flows approximately 70 miles from its headwaters in the Western Diablo Range to its point of discharge in the city of Milpitas located in South San Francisco Bay (SCVURPPP 2001). There are two District-operated reservoirs, Coyote and Anderson, located within the watershed boundaries. Coyote and Anderson reservoirs, constructed in 1936 and 1950, respectively, drain 196 square miles of the watershed and have a combined design capacity of 114,980 acre-feet (SCVWD 2005).

Land use above the dams is primarily rural, however, in the lower watershed downstream of the dams, there is a transition from rural to urban land use. The urbanized area covers approximately 100 square miles (approximately 36 percent) of the lower watershed (SCVURPPP 2001). The 6.1-mile proposed flood protection project resides in the heavily urbanized portion of the lower watershed between Montague Expressway and Interstate 280 in downtown San Jose.

The intent of this habitat typing work is to physically describe the wetted channel by characterizing the aquatic habitat conditions for the Coyote Creek project. The habitat typing will be utilized to assess current channel conditions for anadromous and native fish that occupy, or have the potential to occupy, the project reach. This stream inventory will also serve as the basis for subsequent sub-sampling of habitat units.

The habitat typing survey was conducted between July 31 and August 11, 2006. Daily discharge measurements were recorded because there are no surface water stream gauges on the mainstem of Coyote Creek within the project limits. Furthermore, there are 44 outfalls and two major tributaries that contribute stream flow within the study reach. Measured stream flow during the study period ranged from 3.6 to 18.6 cfs.

Information presented in Appendix B summarizes habitat parameters within the 6.1-mile project reach under the summertime flow conditions described above. Data collected included habitat composition (habitat type, length, width, and depth), in-stream cover (amount and complexity), instream vegetation (amount, type and quality), canopy cover, and quality and quantity of riparian vegetation. The location and amount of spawning gravel were assessed during the low-flow season, which may not be representative of spawning habitat available during the spawning season, which often occurs during higher flows. Therefore spawning gravel was noted if it was in the wetted channel or in the high-flow portion of the channel (which may be wetted during higher flow periods).

2.0
METHODS

2.1 STUDY AREA

The Coyote Creek baseline fisheries habitat study was implemented in the lower, urbanized portion of Coyote Creek. The study area extends approximately 6.1 miles between Montague Expressway and Interstate 280 in the City of San Jose. Additionally, sections of the stream 500 feet upstream and downstream of the primary study reaches were surveyed. The study area consists of sub-reaches (Map 2-1), as follows:

Downstream of Reach 4: 500 feet downstream of Montague Expressway

Reach 4	Montague Expressway to Charcot Avenue
Reach 5	Charcot Avenue to Interstate 880
Reach 6	Interstate 880 to Ridder Park Drive
Reach 7	Ridder Park Drive to Old Oakland Road
Reach 8	Old Oakland Road to Berryessa Road
Reach 9	Berryessa Road to Mabury Road
Reach 10	Mabury Road to Highway 101
Reach 11	Highway 101 to East Julian Street
Reach 12	East Julian Street to East Santa Clara Street
Reach 13	East Santa Clara Street to East William Street
Reach 14	East William Street to Interstate 280

Upstream of Reach 14: Upstream of Interstate 280

2.2 DATA COLLECTION

Data collection was carried out under a Field Protocol prepared by ENTRIX (2006; Appendix A) and approved by the District prior to data collection. The approach primarily consisted of a habitat typing survey to assess current channel conditions for anadromous fish and identify the location of potential spawning gravels for steelhead in the study reach. Surveys were conducted between July 31 and August 11, 2006. The methods used in this approach are discussed below.

2.2.1 DAILY DISCHARGE MEASUREMENT

A discharge measurement was taken daily prior to habitat typing generally following USGS procedures. Velocities and depths were measured in a suitable location (pool tail or run with sufficient current velocities) with a Swoffer current meter. Measurements were taken at a minimum of 10 verticals across each transect and at a minimum of 2.0-

foot intervals. Depths at all transect locations were less than 4 feet, and velocities were measured at 60 percent of the maximum depth using a topset wading rod.

The flow measurement transect was located at a fixed location selected prior to habitat survey commencement for that reach. The flow measurement locations were selected to represent streamflow, including major tributaries flowing into Coyote Creek, within a sub-reach. The streamflow measurement location remained near Montague Expressway (near Charcot Road Bridge and Ridder Park Drive Bridge) while habitat typing was conducted downstream of the confluence of Upper Penitencia Creek, and was located at the Mabury Street Bridge, while habitat typing was conducted between the confluence of Upper Penitencia Creek and Lower Silver Creek. On days that reaches upstream of Lower Silver Creek were surveyed, flow measurements were recorded just upstream of the confluence of Lower Silver Creek. Lower Silver Creek was the most upstream, major tributary encountered.

2.2.2 HABITAT DELINEATION

Habitat units were delineated using a modification of the aquatic habitat classification system described in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). Habitat units were characterized as riffle (low gradient <2 percent, medium gradient >2-4 percent), run, and pool (mid-channel, large woody debris or rootwad formed pool, lateral scour, backwater pool, dammed pool, and confluence pool) type habitats (Table 2-1). All of the delineated habitat units were adjacent to each other, providing continuous coverage throughout the study area.

The length of each habitat unit was measured to the nearest 1-foot with a hip chain.[1] The mean width and depth of each habitat unit, as well as the maximum depth, was measured to the nearest 0.1-foot. Due to the importance of pool tail outs as potential spawning habitat for anadromous fish, they were identified separately, as run habitats.

Habitat inventory data were collected working downstream within each sub-reach. Right and left banks were designated facing in an upstream direction. Field data sheets were checked as each sheet was completed. Landmarks were noted. The locations of habitat units were marked on aerial photographs, where feasible and/or landmarks (e.g bridges, roads, etc.) were available. Global Positioning System (GPS) coordinates (UTM 1983) were taken where feasible.

2.2.3 INSTREAM HABITAT

Instream habitat was evaluated for each habitat unit. Both the cover complexity and the amount of cover were evaluated.

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[1] The length of one pool in Reach 8 (Unit 49), for which length was not recorded on the data sheet, was estimated by taking the map distance between the nearest waypoint locations and subtracting the sum of lengths of recorded units between those waypoint locations.

Cover Complexity

The California Department of Fish Game (CDFG) numerical rating system for instream shelter complexity (Flosi et al. 1998) was used to assess habitat complexity for each habitat unit (Table 2-2). This system rates the complexity of shelter that serves as instream habitat or that creates areas of diverse velocities that are focal points for salmonids.

Cover Amount

The percent (in quartiles) of the area occupied by instream shelter complexity described above for each habitat unit also was assessed (Table 2-3).

Along with an estimate of instream vegetation, a description and visual estimate of the percent (in quartiles) of the type of cover was noted on the data sheet (i.e., floating or submerged aquatic vegetation).

2.2.4 VEGETATION EVALUATION

The amount, type, and quality of vegetation for each habitat unit were evaluated. Canopy cover was measured with a spherical densiometer to determine the mean percent of the habitat unit that is shaded by overhanging vegetation for the habitat unit. The type of vegetation was recorded as deciduous or non-deciduous, and a visual estimate was made of the percent of each, in quartiles.

The quality of vegetation for each habitat unit was rated as follows (Table 2-4) (from Flosi et al. 1998).

2.2.5 SPAWNING GRAVEL ASSESSMENT

Spawning gravel was assessed for each habitat unit as follows:

- Rounded[2], coarse gravels (1 to 13 cm in diameter), located in the tail of pools or riffles that maintained a contiguous spawning gravel area of at least one square meter, were recognized as potential spawning locations.
- Spawning gravel locations were noted on aerial maps (where landmarks were available), data were noted on spawning gravel data sheets, and the GPS coordinates were recorded (if a GPS signal was available). Reach and habitat unit numbers were recorded where spawning gravels were found.
- Length and width of each spawning gravel deposit were recorded.Spawning gravel was noted if it was in the wetted channel or in the high-flow portion of the channel (which may be wetted during higher flow periods).

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[2] Angular gravels are generally considered unsuitable for salmonid spawning.

In Reach 5, a patch of spawning gravel observed in the first run located downstream of O'Toole Avenue could not be measured because a menacing dog forced the field crew out of the channel. Therefore, the size of this location could not be estimated.

Photo Documentation

Photographs were taken of representative habitats (and any unusual features).

2.3 DATA ANALYSIS

Data were evaluated and summarized for each sub-reach within the Coyote Creek Project area, as well as for reaches upstream and downstream of the Project limits. Data were typed into data entry forms and a 100 percent quality control check was completed. Data were input to a MS Access database and various habitat parameters were analyzed and summarized. Data summarized included habitat composition (percent of riffle, run or pool; width, depth and length), instream complexity, instream vegetation, canopy cover and quality and quantity of riparian vegetation. Gravel areas were estimated by assuming gravel deposits to be rectangular and calculating area as length times width.

3.1 RESULTS

Habitats within the surveyed study area (overall reach) were composed primarily of pool habitat types, with lesser amounts of run and low-gradient riffle habitats. Habitat types, as well as lengths, average mean width, average mean depth and average maximum depth for each habitat type are summarized in Table 3-1. Table 3-1 shows that the study area was dominated by pools, particularly by mid-channel pools, which made up 77.4 percent of the length. This habitat type was the most frequently encountered and consisted of the longest lengths per unit. Runs, including pool tailouts, were the second most abundant habitat type making up 15.1 percent of the overall length. Riffles made up only 1.1 percent of the study area length.

A listing of habitats by reach, unit number, habitat type, length, and width is presented in Appendix B.

Locations of aquatic habitat units and spawning gravel are depicted in Maps 3-1 through 3-13 and Maps 3-14 through 3-22, respectively. Data collected during the survey are summarized by sub-reach in the following sections and are discussed from downstream to upstream.[3] Photographs of representative habitats are presented in Appendix C.

3.1.1 DOWNSTREAM OF REACH 4: DOWNSTREAM OF MONTAGUE EXPRESSWAY

The reach downstream of Reach 4 extends under the Montague Expressway to 500 feet downstream of the bridge. A long pool, evaluated as part of this reach, extended for an unknown distance beyond the reach evaluated.

This reach was composed entirely of pool habitats (Table 3-2). Table 3-3 indicates that the pool habitats consisted of four different pool types. These were a 1) mid-channel pool, 2) lateral scour pool, 3) backwater pool, and 4) secondary channel pool formed under Montague Expressway. Length, mean width, and mean depth of each habitat type are presented in Table 3-3. Daily discharge, measured downstream of the Charcot Road Bridge on August 9, when habitat data were collected, was 18.3 cfs (Table 3-4).

No useable spawning gravel was observed in these habitats (Table 3-5).

Shelter complexity values by habitat type ranged from 0 to 2 (Tables 3-8 and 3-9) and averaged 0.5 (Table 3-10). No floating or submerged aquatic vegetation was observed (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 57 to

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[3] The presence of aquatic organisms was noted. However, turbidity levels within the reach limited visual sightings to within surface layers or shallow water areas.

62 percent and the average vegetation quality was high (values of 3 to 4) (Tables 3-9 and 3-10). Averages are presented in Table 3-9.

3.1.2 REACH 4: MONTAGUE EXPRESSWAY TO CHARCOT AVENUE

Reach 4 extends from Montague Expressway at its downstream end to Charcot Avenue at its upstream end.

This reach was composed of pool (15 pools, 53.6 percent by relative frequency of occurrence [count], 81.4 percent by length) and run (13 runs, 46.4 percent by occurrence, 18.6 percent by length) habitats (Tables 3-2 and 3-3). Pool habitats were composed primarily of mid-channel pool (eight pools totaling 2,551 feet) with smaller amounts of lateral scour pool (448 feet total) and one backwater pool (65 feet long) (Table 3-3). Average length, average mean width, and average mean depth of each habitat type is presented in Table 3-3. Daily discharge, measured downstream of the Charcot Road Bridge on August 7, 8 and 9, when habitat data were collected, ranged from 18.0 to 18.6 cfs (Table 3-4).

A total of 1,325 square feet of gravel was measured in the wetted channel of this reach during the study (Table 3-5). Gravels were found in run and pool habitats (Table 3-6). 441 square feet of gravel was located in the wetted channel in run habitat, which can be used for spawning (Table 3-7). An additional 25 square feet of gravel was found in run habitat that was dry during summer flow conditions, but may become wetted and available for spawning during the high-flow season (Table 3-7).

Average shelter complexity values by habitat type were generally low, ranging from 1 to 3 (Tables 3-8 and 3-9) and the overall average was 1.4 (Table 3-10). Submerged and floating aquatic vegetation provided shelter in several pools and runs (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 53.3 to 95 percent and the average vegetation quality was generally high (2.8 to 4) (Tables 3-9 and 3-10).

3.1.3 REACH 5: CHARCOT AVENUE TO INTERSTATE 880

Reach 5 extends from Charcot Avenue at its downstream end to Interstate 880 at its upstream end.

Reach 5 was composed of pool (seven pools, 53.8 percent by relative frequency of occurrence [count], 65.7 percent by length) and run (six runs, 46.2 percent by occurrence, 34.3 percent by length) habitats (Tables 3-2 and 3-3). Pool habitats were composed primarily of mid-channel pool (five pools totaling 1,007 feet) with one lateral scour pool - log enhanced (115 feet long) (Table 3-3). A channel bar stabilized by willows under Interstate 880 separated a run and a shallow side channel pool. This side channel pool (293 feet long) contained bullfrog tadpoles, crayfish, and small, unidentified fish. Average length, average mean width, and average mean depth of each habitat type are presented in Table 3-3. Daily discharge, measured downstream of the Charcot Road Bridge on August 7, when habitat data were collected, was 18.6 cfs (Table 3-4).

A total of 465 square feet of gravel was measured in the wetted channel of this reach during the study (Table 3-5). Gravels were found in run habitats (Table 3-6). An additional 158 square feet of gravel was found in run habitat that was dry during summer flow conditions, but may become wetted and available for spawning during the high-flow season (Table 3-7). Spawning gravel also was observed in the first run located downstream of O'Toole Avenue, but could not be measured.[4]

Average shelter complexity values by habitat type ranged from 1 to 2 (Tables 3-8 and 3-9) and the overall average was 1.5 (Table 3-10). Submerged aquatic vegetation provided shelter in one pool and one run, while floating aquatic vegetation provided shelter in one run (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 52.4 to 68 percent and the average vegetation quality ranged from 1 to 3 (Tables 3-9 and 3-10).

3.1.4 REACH 6: INTERSTATE 880 TO RIDDER PARK DRIVE

Reach 6 extends from Interstate 880 at its downstream end to Ridder Park Drive at its upstream end.

Reach 6 was composed of pool (five pools, 62.5 percent by relative frequency of occurrence [count], 90.1 percent by length), run (two runs, 25 percent by occurrence, 7.9 percent by length) and riffle (one low-gradient riffle, 12.5 percent by occurrence, 2 percent by length) habitats (Table 3-2 and 3-3). Pool habitat was composed primarily of mid-channel pool (four pools totaling 1,163 feet) with one lateral scour pool – root wad enhanced (88 feet long) (Table 3-3). A large, unidentified fish was sighted in the pool upstream of the Interstate 880 Bridge. Average length, average mean width and average mean depth of each habitat type are presented in Table 3-3. Daily discharge, measured downstream of the Charcot Road Bridge on August 7, when habitat data were collected, was 18.6 cfs (Table 3-4).

A total of 1,313 square feet of gravel was measured in the wetted channel of this reach during the study (Table 3-5). Gravels were found in run and lateral scour pool – rootwad enhanced habitats (Table 3-6). 1,008 square feet of gravel was located in the wetted channel in run habitat, which can be used for spawning (Table 3-7). An additional 77 square feet of gravel was found in run habitat that was dry during summer flow conditions, but may become wetted and available for spawning during the high-flow season (Table 3-7).

Average shelter complexity values by habitat type ranged from 1.5 to 3 (Tables 3-8 and 3-9) and the overall average was 1.9 (Table 3-10). No submerged or floating aquatic vegetation was observed (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 48 to 95 percent and average vegetation quality ranged from 2 to 3 (Tables 3-9 and 3-10).

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[4] A menacing dog forced the field crew out of a portion of this habitat unit.

3.1.5 REACH 7: RIDDER PARK DRIVE TO OLD OAKLAND ROAD

Reach 7 extends from Ridder Park Drive at its downstream end to Old Oakland Road at its upstream end.

Reach 7 was composed of pool (six pools, 75 percent by relative frequency of occurrence [count], 79.2 percent by length) and run (three runs, 25 percent by occurrence, 20.8 percent by length) habitats (Tables 3-2 and 3-3). Pool habitat was composed primarily of mid-channel pool (five pools totaling 1,311 feet) (Table 3-3). A 35-foot-long dammed pool was located between a concrete weir and a set of riprap boulders stretched across the stream under the railroad bridge. Average length, average mean width and average mean depth of each habitat type are presented in Table 3-3. Daily discharge, measured at Ridder Park Drive on August 4, when habitat data were collected, was 13.9 cfs, and measured downstream of the Charcot Road Bridge on August 7 was 18.6 cfs (Table 3-4).

No usable spawning gravel was observed in these habitats.

Average shelter complexity values by habitat type ranged from 2.2 to 3 (Tables 3-8 and 3-9) and the overall average was 2.3 (Table 3-10). No submerged or floating aquatic was observed (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 56 to 67 percent and average vegetation quality ranged from 2.3 to 3.8 (Tables 3-9 and 3-10).

3.1.6 REACH 8: OLD OAKLAND ROAD TO BERRYESSA ROAD

Reach 8 extends from Old Oakland Road at its downstream end to Berryessa Road at its upstream end.

Reach 8 was composed of pool (27 pools, 46.6 percent by relative frequency of occurrence [count], 54.6 percent by length), run (26 runs, 44.8 percent by occurrence, 40.9 percent by length), and riffle (five low gradient riffles, 8.6 percent by occurrence, 4.4 percent by length) habitats (Tables 3-2 and 3-3). Pool habitat was composed primarily of mid-channel pool (22 pools totaling 3,129 feet). A smaller number of lateral scour pools was observed (four pools totaling 302 feet) including a log-enhanced and a rootwad-enhanced pool (Table 3-3). Average length, average mean width, and average mean depth of each habitat type is presented in Table 3-3. Daily discharge, measured downstream of the Ridder Park Bridge, was 18.9 cfs on August 3 and 13.9 cfs on August 4, when habitat data were collected (Table 3-4).

A total of 86,798 square feet of spawning gravel was measured in the wetted channel of this reach during the study (Table 3-5). Gravels were found in run, riffle and pool habitats (Table 3-6). 55,311 square feet of gravel was located in the wetted channel in run habitat and 9,837 square feet was located in low gradient riffle habitat, both of which can be used for spawning (Table 3-7). An additional 9,107 square feet of gravel was found in riffle and run habitats that were dry during summer flow conditions, but may become wetted and available for spawning during the high-flow season (Table 3-7). Reach 8 is located directly downstream of Upper Penitencia Creek.

Average shelter complexity values by habitat type ranged from 0.6 to 2 (Tables 3-8 and 3-9) and the overall average was 1.7 (Table 3-10). Submerged vegetation provided shelter in several pools and floating vegetation in one riffle (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 62.3 to 90 percent and average vegetation quality ranged from 0 to 2.8 (Tables 3-9 and 3-10). Large stands of the invasive reed, *Arundo donax*, were observed in some habitat units.

3.1.7 REACH 9: BERRYESSA ROAD TO MABURY ROAD

Reach 9 extends from Berryessa Road at its downstream end to Mabury at its upstream end.

Reach 9 was composed of one long, mid-channel pool (50 percent by occurrence, 97.4 percent by length) and one run (50 percent by occurrence, 2.6 percent by length) habitat (Tables 3-2 and 3-3). The run was the tail of the pool under the Berryessa Road Bridge. The length, mean width, and mean depth of each unit are presented in Table 3-3. Daily discharge, measured downstream of the Ridder Park Bridge on August 2, when habitat data were collected, was 15.0 cfs (Table 3-4).

A total of 760 square feet of gravel was measured in the wetted channel of the run habitat during the study (Tables 3-5 and 3-6).

Average shelter complexity values by habitat type ranged from 0 to 3 (Tables 3-8 and 3-9). No submerged aquatic vegetation was observed (Tables 3-11 and 3-12). Canopy cover for the pool was 86 percent and vegetation quality was 3 (Tables 3-9). (The run was under a bridge.)

3.1.8 REACH 10: MABURY ROAD TO HIGHWAY 101

Reach 10 extends from Mabury Road at its downstream end to Highway 101 at its upstream end.

Reach 10 was composed of mid-channel pool (six pools, 85.7 percent by relative frequency of occurrence [count], 98.5 percent by length) and run (one run, 14.3 percent by occurrence, 1.5 percent by length) habitats (Tables 3-2 and 3-3). Average length, average mean width and average mean depth of each habitat type are presented in Table 3-3. Daily discharge, measured at the Mabury Street Bridge on August 1, when habitat data were collected, was 13.0 cfs (Table 3-4).

A total of 506 square feet of gravel was measured in the wetted channel of this reach during the study (Table 3-5). Gravels were found in run and pool habitats (Table 3-6). 282 square feet of gravel was located in the wetted channel in run habitat, which can be used for spawning (Table 3-7). An additional 559 square feet of gravel was found in run habitat that was dry during summer flow conditions, but may become wetted and available for spawning during the high-flow season (Table 3-7).

Average shelter complexity values by habitat type ranged from 1 to 2 (Tables 3-8 and 3-9), with an overall average of 1.1 (Table 3-10). No submerged aquatic vegetation was observed (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 74 to 74.6 percent and average vegetation quality ranged from 1.5 to 2.0 (Tables 3-9 and 3-10).

3.1.9 REACH 11: HIGHWAY 101 TO EAST JULIAN STREET

Reach 11 extends from Highway 101 at its downstream end to East Julian Street at its upstream end.

Reach 11 was composed primarily of pool habitat (11 pools, 75 percent by relative frequency of occurrence [count], 94.9 percent by length), with smaller amounts of run (three runs, 18.8 percent by occurrence, 4.1 percent by length) and riffle (one low gradient riffle, 6.3 percent by occurrence, 1 percent by length) habitats (Tables 3-2 and 3-3). Pool habitat was composed primarily of mid-channel pool (six pools totaling 2,729 feet). Lateral scour pools included two log-enhanced pools, one rootwad enhanced pool, and one lateral scour pool. A backwater pool and a channel confluence pool (located at the confluence of Lower Silver Creek) also were recorded (Table 3-3). Average length, average mean width, and average mean depth of each habitat type are presented in Table 3-3. Daily discharge, measured at the Mabury Street Bridge, was 13.8 cfs on July 31 and 13.6 on August 1, when habitat data were collected (Table 3-4).

A total of 727 square feet of gravel was measured in the wetted channel of this reach during the study (Table 3-5). Gravels were found in run, low gradient riffle and lateral scour pool habitats (Table 3-6). 50 square feet of gravel was located in the wetted channel in run habitat and 437 square feet in low gradient riffle habitat, both of which can be used for spawning (Table 3-7).

Average shelter complexity values by habitat type ranged from 0 to 3 (Tables 3-8 and 3-9) and the overall average was 1.5 (Table 3-10). No submerged aquatic vegetation was observed (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 0 to 97 percent and average vegetation quality ranged from 1 to 4 (Tables 3-9 and 3-10).

3.1.10 REACH 12: EAST JULIAN STREET TO EAST SANTA CLARA STREET

Reach 12 extends from East Julian Street at its downstream end to East Santa Clara Street at its upstream end.

Reach 12 was composed entirely of mid-channel pool habitat (Tables 3-2 and 3-3). The head of this pool was located at the downstream end of the East William Street Bridge in Reach 13 and extended approximately 1,176 feet into Reach 11. The segment of this pool that flowed through Reach 12 was 5,752 feet long. Daily discharge, measured upstream of the confluence with Lower Silver Creek on August 11, when habitat data were collected, was 3.6 cfs (Table 3-4).

No useable spawning gravel was observed in this pool. The substrate of much of this pool was composed of deep mud.

Shelter complexity for the pool was 1 (Table 3-9), although downed trees and debris (wood and garbage) provided high-density shelter in isolated areas. No submerged aquatic vegetation was observed (Tables 3-11 and 3-12). Canopy cover was 81.0 percent and vegetation quality was rated 3 (Tables 3-9 and 3-10).

3.1.11 REACH 13: EAST SANTA CLARA STREET TO EAST WILLIAM STREET

Reach 13 extends from East Santa Clara Street at its downstream end to East William Street at its upstream end.

Reach 13 was composed entirely of one mid-channel pool habitat (Tables 3-2 and 3-3). The head of this pool was located at the downstream end of the East William Street Bridge and extended through Reach 12 and into Reach 11. Mean width and mean depth are presented in Table 3-3. Daily discharge, measured upstream of the confluence with Lower Silver Creek, was 3.6 cfs on August 11, when habitat data were collected (Table 3-4).

No useable spawning gravel was observed. Habitat values for this pool were the same as for Reach 12.

3.1.12 REACH 14: EAST WILLIAM STREET TO INTERSTATE 280

Reach 14 extends from East William Street at its downstream end to Interstate 280 at its upstream end.

Reach 14 was composed of pool habitat (16 pools, 61.5 percent by relative frequency of occurrence [count], 78.9 percent by length), with a smaller amount of run habitat (10 runs, 38.5 percent by occurrence, 21.1 percent by length) (Tables 3-2 and 3-3). Pool habitat was composed primarily of mid-channel pool (15 pools totaling 2,231 feet), with one lateral scour pool – rootwad enhanced (90 feet long) (Table 3-3). Average length, average mean width, and average mean depth of each habitat type are presented in Table 3-3. Daily discharge, measured upstream of the confluence with Lower Silver Creek on August 10, when habitat data were collected, was 4.4 cfs (Table 3-4).

A total of 384 square feet of gravel was measured in the wetted channel of run habitat during the study (Table 3-5 and 3-6).

Average shelter complexity values by habitat type ranged from 0.8 to 3 (Tables 3-8 and 3-9) and the overall average was 1.2 (Table 3-10). No submerged aquatic vegetation was observed (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 69.2 to 86 percent and average vegetation quality ranged from 2.7 to 3 (Tables 3-9 and 3-10).

3.1.13 UPSTREAM OF REACH 14: UPSTREAM OF INTERSTATE 280

The reach upstream of Reach 14 extends 622 feet upstream from Interstate 280.

The reach upstream of Reach 14 was composed of pool (four pools, 50 percent by relative frequency of occurrence [count], 83.4 percent by length), run (three runs, 37.5 percent by occurrence, 15 percent by length) and riffle (one low gradient riffle, 12.5 percent by occurrence, 1.6 percent by length) habitats (Tables 3-2 and 3-3). Pool habitat was composed primarily of mid-channel pool (3 pools totaling 511 feet), with one backwater pool (49 feet long) (Table 3-3). Average length, average mean width, and average mean depth of each habitat type are presented in Table 3-3. Daily discharge, measured upstream of the confluence with Lower Silver Creek on August 10, when habitat data were collected, was 4.4 cfs (Table 3-4).

A total of 132 square feet of gravel was measured in the wetted channel during the study (Table 3-5), all located in run habitat (Table 3-6).

Average shelter complexity values by habitat type ranged from 1 to 2.3 (Tables 3-8 and 3-9) and the overall average was 1.8 (Table 3-10). No submerged aquatic vegetation was observed (Tables 3-11 and 3-12). Average canopy cover for each habitat type ranged from 74 to 85 percent and average vegetation quality ranged from 2 to 3.7 (Tables 3-9 and 3-10).

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TABLES

Table 2-1. Habitat Types and Codes (adapted from Flosi et al. 1998).

Code	Habitat Type	Description
LGR	Low gradient riffle	Shallow reaches with swiftly flowing, turbulent water with some partially exposed substrate. Gradient <2 percent. Substrate usually cobble dominated.
MGR	Medium gradient riffle	Shallow reaches with swiftly flowing, turbulent water with some partially exposed substrate. Gradient >2 to 4 percent. Substrate usually cobble dominated
RUN	Run	Swiftly flowing reaches with little surface agitation and no major flow obstructions. Often appears as flooded riffles. Typical substrate consists of gravel, cobble and boulders
MCP	Mid-channel pool	Large pools formed by mid-channel scour. The sour hole encompasses more than 60 percent of the wetted channel. Water velocity is slow, and the substrate is highly variable.
LSL	Lateral scour pool – log enhanced	Formed by flow impinging against a partial channel obstruction consisting of large woody debris. The associated scour is generally confined to <60 percent of the wetted channel width
LSR	Lateral scour pool – rootwad enhanced	Formed by flow impinging against a partial channel obstruction consisting of a root wad. The associated scour is generally confined to <60 percent of the wetted channel width
LSP	Lateral scour pool	Formed by flow impinging against a partial channel obstruction. The associated scour is generally confined to <60 percent of the wetted channel width
BWP	Backwater pool	Found along channel margins and caused by eddies around an obstruction. These pools are usually shallow and are dominated by fine-grained substrate. Current velocities are quite low.
DPL	Dammed pool	Water impounded from a complete or nearly complete channel blockage (log debris jams, rock landslides or dams). Substrate tends to be dominated by smaller gravel and sand
CCP	Channel confluence pool	Large pools formed at the confluence of two or more channels.

Table 2-2. Cover Complexity Values.

Value	Description
0	No shelter
1	• One to five boulders; • Bare undercut bank; • Single piece of large wood (12" in diameter and 6' long) defined as large woody debris (LWD).
2	• One or two pieces of LWD associated with any amount of small wood (<12" diameter) defined as small woody debris (SWD); • Six or more boulders per 50 feet; Stable undercut bank with root mass, and less than 12" undercut; • A single root wad lacking complexity; • Branches in or near the water; • Limited submersed vegetative fish cover; • Bubble curtain.
3	**Combinations of (must have at least two cover types):** • LWD/boulders/root wads; Three or more pieces of LWD combined with SWD; • Three or more boulders combined with LWD/SWD; • Bubble curtain combined with LWD or boulders; • Stable undercut bank with > than 12" undercut, associated with root mass or LWD; • Extensive submersed vegetative fish cover.

Table 2-3. Definition of Quartiles used for Assessment of Amount of Instream Complexity.

Quartile	Definition
0	No cover
1	1 to 25 percent
2	26 to 50 percent
3	51 to 75 percent
4	76 to 100 percent

Table 2-4. Quality of Vegetation Values.

Value	Description
1	Trees are rare or absent, and shrub cover is sparse and clumped. Growth and reproduction vigor is generally poor. Root mass is likely to be discontinuous and shallow.
2	Lack of vigor is evident in some individuals or species. Tree seedling reproduction is minimal. Much of the segment lacks vegetation and the potential for a deep root mass. Serious erosion is likely at high streamflows.
3	Openings in the tree canopy are larger than the space resulting from the loss of a single mature individual. Although plant growth appears good, few or no large and old trees and shrubs are present. A deep root mass may not seem continuous, and significant erosion is possible in the openings during high stream flows.
4	Combined cover of trees, shrubs, grass and forbs is very dense on the banks of each individual habitat unit. Openings in canopy cover are small and dispersed. Many plant species and age classes are represented. Growth is vigorous and the age or size of the structure of plants suggests continued ground cover. A deep, dense root mass is likely.

Table 3-1. Project Area Habitats by Type, Count, Length, Width, and Depth.

Habitat Unit Type (code)	Count of Habitat Units	Sum of Lengths (ft)	Average Unit Length (ft)	Average of Unit Mean Widths (ft)	Average of Unit Mean Depths (ft)	Average of Unit Maximum Depths (ft)
Backwater Pool (BWP)	5	283.7	56.7	22.4	1.6	2.1
Channel Confluence Pool (CCP)	1	22.3	22.3	18.0	1.5	2.4
Dammed Pool (DPL)	1	35.0	35.0	31.6	4.0	4.5
Lateral Scour Pool – Log Enhanced (LSL)	4	359.8	90.0	21.2	2.1	4.1
Lateral Scour Pool (LSP)	8	826.3	103.3	23.6	1.8	2.9
Lateral Scour Pool – Root Wad Enhanced (LSR)	6	391.3	65.2	15.8	2.4	3.6
Mid-Channel Pool (MCP)	78	27,920.7	358.0	23.1	2.4	3.9
Secondary Channel Pool (SCP)	2	426.6	213.3	10.8	0.8	1.0
Run (RUN)	68	5,441.2	80.0	19.1	0.9	1.5
Low Gradient Riffle (LGR)	8	354.4	44.3	25.1	0.6	1.3

Table 3-2. Percentage of Pool, Run and Riffle Habitat by Subreach.

Habitat:	Pool		Run		Riffle	
Stream Reach Subreach	**Percent by Occurrence**	**Percent by Length**	**Percent by Occurrence**	**Percent by Length**	**Percent by Occurrence**	**Percent by Length**
Downstream of Reach 4	100.0	100.0				
Reach 4	53.6	81.4	46.4	18.6		
Reach 5	53.8	65.7	46.2	34.3		
Reach 6	62.5	90.1	25.0	7.9	12.5	2.0
Reach 7	75.0	79.2	25.0	20.8		
Reach 8	46.6	54.6	44.8	40.9	8.6	4.4
Reach 9	50.0	97.4	50.0	2.6		
Reach 10	85.7	98.5	14.3	1.5		
Reach 11	75.0	94.9	18.8	4.1	6.3	1.0
Reach 12	100.0	100.0				
Reach 13	100.0	100.0				
Reach 14	61.5	78.9	38.5	21.1		
Upstream of Reach 14	50.0	83.4	37.5	15.0	12.5	1.6

Table 3-3. Subreach Habitats by Type, Count, Length, Width, and Depth.

Stream Reach Subreach	Habitat Unit Type (code)	Count of Habitat Units	Sum of Lengths (ft)	Average Length (ft)	Average of Mean Widths (ft)	Average of Mean Depths (ft)	Average of Maximum Depths (ft)
Downstream of Reach 4	Backwater Pool (BWP)	1	39.0	39.0	17.1	1.5	1.7
Downstream of Reach 4	Lateral Scour Pool (LSP)	1	133.7	133.7	25.9	1.0	1.5
Downstream of Reach 4	Mid-Channel Pool (MCP)	1	500.0	500.0	23.9	1.5	2.4
Downstream of Reach 4	Secondary Channel Pool (SCP)	1	133.7	133.7	9.0	0.9	1.0
Reach 4	Backwater Pool (BWP)	1	64.8	64.8	16.6	1.5	2.0
Reach 4	Lateral Scour Pool (LSP)	4	300.3	75.1	20.0	1.7	2.7
Reach 4	Lateral Scour Pool – Root Wad Enhanced (LSR)	2	147.3	73.7	20.4	2.0	3.5
Reach 4	Mid-Channel Pool (MCP)	8	2,550.6	318.8	23.0	2.0	3.6
Reach 4	Run (RUN)	13	701.5	54.0	18.1	0.9	1.5
Reach 5	Lateral Scour Pool – Log Enhanced (LSL)	1	114.9	114.9	18.3	2.1	5.0
Reach 5	Mid-Channel Pool (MCP)	5	1,007.4	201.5	24.3	2.5	3.6
Reach 5	Run (RUN)	6	738.0	123.0	21.2	1.0	1.6
Reach 5	Secondary Channel Pool (SCP)	1	292.9	292.9	12.6	0.6	1.0
Reach 6	Low Gradient Riffle (LGR)	1	27.6	27.6	25.2	1.0	1.1
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	1	88.1	88.1	15.5	5.0	6.0
Reach 6	Mid-Channel Pool (MCP)	4	1,163.4	290.9	25.5	2.8	5.5
Reach 6	Run (RUN)	2	109.9	55.0	24.7	0.9	1.5
Reach 7	Dammed Pool (DPL)	1	35.0	35.0	31.6	4.0	4.5
Reach 7	Mid-Channel Pool (MCP)	5	1,310.5	262.1	24.4	2.9	5.1
Reach 7	Run (RUN)	3	353.6	117.9	20.0	1.1	1.7
Reach 8	Backwater Pool (BWP)	1	29.8	29.8	17.3	2.0	2.1
Reach 8	Low Gradient Riffle (LGR)	5	281.3	56.3	29.5	0.5	1.4
Reach 8	Lateral Scour Pool – Log Enhanced (LSL)	1	48.3	48.3	18.5	2.5	4.2

Table 3-3. Subreach Habitats by Type, Count, Length, Width, and Depth (continued).

Stream Reach Sub Reach	Habitat Unit Type (code)	Count of Habitat Units	Sum of Lengths (ft)	Average Length (ft)	Average of Mean Widths (ft)	Average of Mean Depths (ft)	Average of Maximum Depths (ft)
Reach 8	Lateral Scour Pool (LSP)	2	220.9	110.5	29.0	2.0	3.6
Reach 8	Lateral Scour Pool – Root Wad Enhanced (LSR)	1	32.6	32.6	13.0	1.8	3.7
Reach 8	Mid-Channel Pool (MCP)	22	3,128.8	142.2	23.0	2.2	3.5
Reach 8	Run (RUN)	26	2,594.4	99.8	21.1	1.0	1.8
Reach 9	Mid-Channel Pool (MCP)	1	2,293.8	2,293.8	40.0	5.0	8.6
Reach 9	Run (RUN)	1	60.1	60.1	28.7	1.1	1.8
Reach 10	Mid-Channel Pool (MCP)	6	1,408.6	234.8	29.1	2.8	4.5
Reach 10	Run (RUN)	1	22.0	22.0	12.1	0.8	1.2
Reach 11	Backwater Pool (BWP)	1	101.6	101.6	46.9	1.2	2.2
Reach 11	Channel Confluence Pool (CCP)	1	22.3	22.3	18.0	1.5	2.4
Reach 11	Low Gradient Riffle (LGR)	1	34.5	34.5	11.8	0.9	1.3
Reach 11	Lateral Scour Pool – Log Enhanced (LSL)	2	196.6	98.3	23.9	1.8	3.5
Reach 11	Lateral Scour Pool (LSP)	1	171.4	171.4	24.6	2.6	4.0
Reach 11	Lateral Scour Pool – Root Wad Enhanced (LSR)	1	32.9	32.9	13.8	1.6	2.1
Reach 11	Mid-Channel Pool (MCP)	6	2,729.1	454.9	23.5	3.8	5.3
Reach 11	Run (RUN)	3	138.6	46.2	20.7	0.8	1.6
Reach 12	Mid-Channel Pool (MCP)	1	5,752.0	5,752.0	21.4	3.0	6.8
Reach 13	Mid-Channel Pool (MCP)	1	3,335.1	3,335.1	21.4	2.3	5.2
Reach 14	Lateral Scour Pool – Root Wad Enhanced (LSR)	1	90.4	90.4	11.6	2.0	3.0
Reach 14	Mid-Channel Pool (MCP)	15	2,230.6	148.7	19.8	1.7	2.7
Reach 14	Run (RUN)	10	622.5	62.3	14.1	0.7	1.2
Upstream of Reach 14	Backwater Pool (BWP)	1	48.5	48.5	14.0	2.0	2.5
Upstream of Reach 14	Low Gradient Riffle (LGR)	1	11.0	11.0	16.0	0.5	1.3
Upstream of Reach 14	Mid-Channel Pool (MCP)	3	510.8	170.3	17.1	1.5	3.1
Upstream of Reach 14	Run (RUN)	3	100.6	33.5	11.8	0.8	1.1

Table 3-4. Flow during Coyote Creek Baseline Fisheries Habitat Study.

Location	Date	Flow (cfs)	Representing Flow in Subreach
Mabury St Bridge	July 31, 2006	13.8	11
Mabury St Bridge	August 1, 2006	13.6	10, 11
Mabury St Bridge	August 2, 2006	15.0	9
Ridder Park Dr Bridge	August 3, 2006	18.6	8
Ridder Park Dr Bridge	August 4, 2006	13.9	7, 8
Downstream of Charcot Road Bridge	August 7, 2006	18.6	4, 5, 6, 7
Downstream of Charcot Road Bridge	August 8, 2006	18.0	4
Downstream of Charcot Road Bridge	August 9, 2006	18.3	4, Downstream of Montague
Upstream of Lower Silver Creek	August 10, 2006	4.4	14, Upstream of I-280
Upstream of Lower Silver Creek	August 11, 2006	3.6	13, 12, 11

Table 3-5. Spawning Gravel by Reach, Wetted Channel Only.

Stream Reach Subreach	Sum of Areas Estimated (ft²)
Reach 4	1,324.7
Reach 5	465.2
Reach 6	1313.0
Reach 8	86,797.6
Reach 9	759.8
Reach 10	505.6
Reach 11	726.9
Reach 14	384.0
Upstream I-280 Bridge	131.6

Table 3-6. Spawning Gravel Observations, Details by Subreach and Habitat Unit.

Stream Reach Subreach	Habitat Unit Type (code)	Length (ft)	Width (ft)	Area Estimate (ft²)	UTM-Northing	UTM-Easting	Location of Gravel (WC=Wetted Channel DC=Dry Channel)
Reach 4	Lateral Scour Pool (LSP)	59.5	14.3	850.9			WC
Reach 4	Lateral Scour Pool (LSP)	21.0	11.5	241.5			DC
Reach 4	Mid-Channel Pool (MCP)	5.0	6.5	32.5	4138694	0596515	WC
Reach 4	Run (RUN)	5.0	5.0	25.0			DC
Reach 4	Run (RUN)	21.4	12.4	265.4			WC
Reach 4	Run (RUN)	11.0	16.0	176.0	4138326	059654	WC
Reach 5	Run (RUN)	21.0	7.5	157.5			DC
Reach 5	Run (RUN)	14.0	5.0	70.0			WC
Reach 5	Run (RUN)		25.0				WC
Reach 5	Run (RUN)	38.0	10.4	395.2	4138106	0596704	WC
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	30.5	10.0	305.0			WC
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	30.5	10.0	305.0			DC
Reach 6	Run (RUN)	38.3	2.0	76.6	4137849	0597084	DC
Reach 6	Run (RUN)	50.4	20.0	1,008.0	4137849	0597084	WC
Reach 8	Backwater Pool (BWP)	9.0	5.0	45.0			WC
Reach 8	Backwater Pool (BWP)	6.0	5.0	30.0			DC
Reach 8	Low Gradient Riffle (LGR)	36.9	39.0	1,439.1			WC
Reach 8	Low Gradient Riffle (LGR)	15.0	16.0	240.0			WC

Table 3-6. Spawning Gravel Observations, Details by Subreach and Habitat Unit (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Length (ft)	Width (ft)	Area Estimate (ft²)	UTM-Northing	UTM-Easting	Location of Gravel (WC=Wetted Channel DC=Dry Channel)
Reach 8	Low Gradient Riffle (LGR)	15.0	11.0	165.0			DC
Reach 8	Low Gradient Riffle (LGR)	48.6	27.0	1,312.2			WC
Reach 8	Low Gradient Riffle (LGR)	124.8	37.8	4,717.4	4136295	0599077	WC
Reach 8	Low Gradient Riffle (LGR)	56.0	38.0	2,128.0	4136361	0598953	WC
Reach 8	Low Gradient Riffle (LGR)	135.9	15.5	2,106.5	4136295	0599077	DC
Reach 8	Lateral Scour Pool – Root Wad Enhanced (LSR)	32.6	15.3	498.8			DC
Reach 8	Mid-Channel Pool (MCP)	62.0	9.1	564.2			WC
Reach 8	Mid-Channel Pool (MCP)	160.4	27.0	4,330.8			WC
Reach 8	Mid-Channel Pool (MCP)	103.6	32.5	3,367.0	4136599	0598614	WC
Reach 8	Mid-Channel Pool (MCP)	229.9	32.3	7,425.8	4136487	0598719	WC
Reach 8	Mid-Channel Pool (MCP)	44.5	23.5	1,045.8	4136402	0598900	WC
Reach 8	Mid-Channel Pool (MCP)	54.2	1.3	70.5			DC
Reach 8	Mid-Channel Pool (MCP)	129.1	33.6	4,337.8	4136442	0598866	WC
Reach 8	Mid-Channel Pool (MCP)	50.8	10.5	533.4			WC
Reach 8	Run (RUN)	5.0	4.0	20.0			DC
Reach 8	Run (RUN)	385.2	28.2	10,862.6	4136442	0598866	WC
Reach 8	Run (RUN)	115.2	20.8	2,396.2	4136789	0598437	WC
Reach 8	Run (RUN)	115.7	23.4	2,707.4	4136402	0598900	WC
Reach 8	Run (RUN)	94.6	13.4	1,267.6			WC

Table 3-6. Spawning Gravel Observations, Details by Subreach and Habitat Unit (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Length (ft)	Width (ft)	Area Estimate (ft^2)	UTM-Northing	UTM-Easting	Location of Gravel (WC=Wetted Channel DC=Dry Channel)
Reach 8	Run (RUN)	57.2	38.0	2,173.6	4136361	0598953	WC
Reach 8	Run (RUN)	185.8	22.7	4,217.7	4136793	0598446	WC
Reach 8	Run (RUN)	43.3	16.5	714.5			WC
Reach 8	Run (RUN)	96.1	25.0	2,402.5			WC
Reach 8	Run (RUN)	18.8	16.4	308.3	4137266	0598152	WC
Reach 8	Run (RUN)	85.0	7.5	637.5			WC
Reach 8	Run (RUN)	88.6	10.5	930.3			WC
Reach 8	Run (RUN)	26.0	7.8	202.8	4137320	0598018	WC
Reach 8	Run (RUN)	17.0	13.0	221.0			WC
Reach 8	Run (RUN)	28.7	15.3	439.1			DC
Reach 8	Run (RUN)	72.9	17.5	1,275.8			WC
Reach 8	Run (RUN)	18.5	18.9	349.7			WC
Reach 8	Run (RUN)	27.0	28.0	756.0	4136964	0598344	DC
Reach 8	Run (RUN)	25.4	3.0	76.2	4136793	0598446	DC
Reach 8	Run (RUN)	153.8	25.1	3,860.4	4136964	0598344	WC
Reach 8	Run (RUN)	43.8	15.0	657.0	4136761	0598464	WC
Reach 8	Run (RUN)	22.0	10.0	220.0	4136746	0598492	DC
Reach 8	Run (RUN)	133.9	34.6	4,632.9	4136746	0598492	DC
Reach 8	Run (RUN)	31.5	11.0	346.5			DC
Reach 8	Run (RUN)	133.9	17.4	2,329.9	4136746	0598492	WC

Table 3-6. Spawning Gravel Observations, Details by Subreach and Habitat Unit (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Length (ft)	Width (ft)	Area Estimate (ft^2)	UTM-Northing	UTM-Easting	Location of Gravel (WC=Wetted Channel DC=Dry Channel)
Reach 8	Run (RUN)	170.1	21.5	3,657.2			WC
Reach 8	Run (RUN)	31.2	27.0	842.4			WC
Reach 8	Run (RUN)	31.4	8.0	251.2			DC
Reach 8	Run (RUN)	46.9	2.0	93.8	4136649	0598548	DC
Reach 8	Run (RUN)	46.9	27.0	1,266.3	4136649	0598548	WC
Reach 8	Run (RUN)	80.1	29.7	2,379.0	4136599	0598614	WC
Reach 8	Run (RUN)	135.8	20.2	2,743.2			WC
Reach 8	Run (RUN)	101.9	38.5	3,923.2	4136584	0598634	WC
Reach 8	Run (RUN)	132.1	22.6	2,985.5	4136544	0598655	WC
Reach 9	Run (RUN)	20.1	37.8	759.8	4136295	0599077	WC
Reach 10	Mid-Channel Pool (MCP)	17.5	12.8	224.0	4135415	0599733	WC
Reach 10	Run (RUN)	31.0	10.0	310.0			DC
Reach 10	Run (RUN)	35.5	7.0	248.5			DC
Reach 10	Run (RUN)	22.0	12.8	281.6			WC
Reach 11	Low Gradient Riffle (LGR)	48.6	9.0	437.4	4135343	0599735	WC
Reach 11	Lateral Scour Pool (LSP)	24.0	10.0	240.0	4135034	0599742	WC
Reach 11	Run (RUN)	11.0	4.5	49.5	4135019	0599738	WC
Reach 14	Run (RUN)	24.0	16.0	384.0			WC

Table 3-6. Spawning Gravel Observations, Details by Subreach and Habitat Unit (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Length (ft)	Width (ft)	Area Estimate (ft^2)	UTM-Northing	UTM-Easting	Location of Gravel (WC=Wetted Channel DC=Dry Channel)
Upstream I-280 Bridge	Run (RUN)	6.5	4.3	28.0	4131984	0600260	WC
Upstream I-280 Bridge	Run (RUN)	10.0	4.0	40.0			WC
Upstream I-280 Bridge	Run (RUN)	10.6	6.0	63.6	413189	0600342	WC

Table 3-7. Spawning Gravel by Subreach, Habitat Type, and whether Channel Area Containing Gravel was Wet or Dry at Time of Sampling.

Stream Reach Subreach	Habitat Unit Type (code)	Location of Gravel (WC=Wetted Channel DC=Dry Channel)	Area Estimate (ft^2)
Reach 4	Lateral Scour Pool (LSP)	WC	850.9
Reach 4	Lateral Scour Pool (LSP)	DC	241.5
Reach 4	Mid-Channel Pool (MCP)	WC	32.5
Reach 4	Run (RUN)	WC	441.4
Reach 4	Run (RUN)	DC	25.0
Reach 5	Run (RUN)	WC	465.2
Reach 5	Run (RUN)	DC	157.5
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	WC	305.0
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	DC	305.0
Reach 6	Run (RUN)	WC	1,008.0
Reach 6	Run (RUN)	DC	76.6
Reach 8	Backwater Pool (BWP)	WC	45.0
Reach 8	Backwater Pool (BWP)	DC	30.0
Reach 8	Low Gradient Riffle (LGR)	WC	9,836.7
Reach 8	Low Gradient Riffle (LGR)	DC	2,271.5
Reach 8	Lateral Scour Pool – Root Wad Enhanced (LSR)	DC	498.8
Reach 8	Mid-Channel Pool (MCP)	WC	21,604.7
Reach 8	Mid-Channel Pool (MCP)	DC	70.5
Reach 8	Run (RUN)	WC	55,311.2
Reach 8	Run (RUN)	DC	6,835.8
Reach 9	Run (RUN)	WC	759.8
Reach 10	Mid-Channel Pool (MCP)	WC	224.0
Reach 10	Run (RUN)	WC	281.6
Reach 10	Run (RUN)	DC	558.5
Reach 11	Low Gradient Riffle (LGR)	WC	437.4
Reach 11	Lateral Scour Pool (LSP)	WC	240.0
Reach 11	Run (RUN)	WC	49.5
Reach 14	Run (RUN)	WC	384.0
Upstream I-280 Bridge	Run (RUN)	WC	131.6

Table 3-8. Frequency of Shelter Complexity Quartiles by Habitat and Subreach.

Stream Reach Subreach	Habitat Unit Type (code)	Shelter Complexity Value	Number of Habitat Units with this Shelter Complexity Value
Downstream of Reach 4	Backwater Pool (BWP)	0	1
Downstream of Reach 4	Lateral Scour Pool (LSP)	0	1
Downstream of Reach 4	Mid-Channel Pool (MCP)	2	1
Downstream of Reach 4	Secondary Channel Pool (SCP)	0	1
Reach 4	Backwater Pool (BWP)	3	1
Reach 4	Lateral Scour Pool (LSP)	0	1
Reach 4	Lateral Scour Pool (LSP)	1	2
Reach 4	Lateral Scour Pool (LSP)	2	1
Reach 4	Lateral Scour Pool – Root Wad Enhanced (LSR)	3	2
Reach 4	Mid-Channel Pool (MCP)	1	3
Reach 4	Mid-Channel Pool (MCP)	2	5
Reach 4	Run (RUN)	0	2
Reach 4	Run (RUN)	1	8
Reach 4	Run (RUN)	2	3
Reach 5	Lateral Scour Pool – Log Enhanced (LSL)	2	1
Reach 5	Mid-Channel Pool (MCP)	1	1
Reach 5	Mid-Channel Pool (MCP)	2	4
Reach 5	Run (RUN)	0	1
Reach 5	Run (RUN)	1	2
Reach 5	Run (RUN)	2	3
Reach 5	Secondary Channel Pool (SCP)	1	1
Reach 6	Low Gradient Riffle (LGR)	3	1
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	3	1
Reach 6	Mid-Channel Pool (MCP)	1	2
Reach 6	Mid-Channel Pool (MCP)	2	2
Reach 6	Run (RUN)	1	1
Reach 6	Run (RUN)	2	1
Reach 7	Dammed Pool (DPL)	3	1
Reach 7	Mid-Channel Pool (MCP)	2	4
Reach 7	Mid-Channel Pool (MCP)	3	1
Reach 7	Run (RUN)	2	2
Reach 7	Run (RUN)	3	1
Reach 8	Backwater Pool (BWP)	2	1
Reach 8	Low Gradient Riffle (LGR)	0	2
Reach 8	Low Gradient Riffle (LGR)	1	3
Reach 8	Lateral Scour Pool – Log Enhanced (LSL)	2	1

Table 3-8. **Frequency of Shelter Complexity Quartiles by Habitat and Subreach (continued).**

Stream Reach Subreach	Habitat Unit Type (code)	Shelter Complexity Value	Number of Habitat Units with this Shelter Complexity Value
Reach 8	Lateral Scour Pool (LSP)	1	1
Reach 8	Lateral Scour Pool (LSP)	3	1
Reach 8	Lateral Scour Pool – Root Wad Enhanced (LSR)	2	1
Reach 8	Mid-Channel Pool (MCP)	1	4
Reach 8	Mid-Channel Pool (MCP)	2	13
Reach 8	Mid-Channel Pool (MCP)	3	5
Reach 8	Run (RUN)	0	3
Reach 8	Run (RUN)	1	9
Reach 8	Run (RUN)	2	13
Reach 8	Run (RUN)	3	1
Reach 9	Mid-Channel Pool (MCP)	3	1
Reach 9	Run (RUN)	0	1
Reach 10	Mid-Channel Pool (MCP)	0	2
Reach 10	Mid-Channel Pool (MCP)	1	2
Reach 10	Mid-Channel Pool (MCP)	2	2
Reach 10	Run (RUN)	2	1
Reach 11	Backwater Pool (BWP)	1	1
Reach 11	Channel Confluence Pool (CCP)	0	1
Reach 11	Low Gradient Riffle (LGR)	2	1
Reach 11	Lateral Scour Pool – Log Enhanced (LSL)	2	1
Reach 11	Lateral Scour Pool – Log Enhanced (LSL)	4	1
Reach 11	Lateral Scour Pool (LSP)	3	1
Reach 11	Lateral Scour Pool – Root Wad Enhanced (LSR)	1	1
Reach 11	Mid-Channel Pool (MCP)	1	4
Reach 11	Mid-Channel Pool (MCP)	2	1
Reach 11	Mid-Channel Pool (MCP)	3	1
Reach 11	Run (RUN)	0	1
Reach 11	Run (RUN)	1	2
Reach 12	Mid-Channel Pool (MCP)	1	1
Reach 13	Mid-Channel Pool (MCP)	1	1
Reach 14	Lateral Scour Pool – Root Wad Enhanced (LSR)	3	1
Reach 14	Mid-Channel Pool (MCP)	1	12
Reach 14	Mid-Channel Pool (MCP)	2	2
Reach 14	Mid-Channel Pool (MCP)	3	1

Table 3-8. Frequency of Shelter Complexity Quartiles by Habitat and Subreach (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Shelter Complexity Value	Number of Habitat Units with this Shelter Complexity Value
Reach 14	Run (RUN)	0	3
Reach 14	Run (RUN)	1	6
Reach 14	Run (RUN)	2	1
Upstream of Reach 14	Backwater Pool (BWP)	2	1
Upstream of Reach 14	Low Gradient Riffle (LGR)	1	1
Upstream of Reach 14	Mid-Channel Pool (MCP)	1	1
Upstream of Reach 14	Mid-Channel Pool (MCP)	3	2
Upstream of Reach 14	Run (RUN)	1	2
Upstream of Reach 14	Run (RUN)	2	1

Table 3-9. Habitat Quality Classification Average Scores by Subreach and Habitat Type.

Stream Reach Subreach	Habitat Unit Type (code)	Average of Shelter Complexity (value) [1]	Average of Unit Covered (quartile) [2]	Average of Canopy Cover (percent)	Average of Deciduous (quartile)	Average of Non-Deciduous (quartile)	Average of Vegetation Quality (value) [3]
Downstream of Reach 4	Backwater Pool (BWP)	0.0	0.0	62.0	4.0	0.0	4.0
Downstream of Reach 4	Lateral Scour Pool (LSP)	0.0	0.0				
Downstream of Reach 4	Mid-Channel Pool (MCP)	2.0	1.0	57.0	1.0	3.0	3.0
Downstream of Reach 4	Secondary Channel Pool (SCP)	0.0	0.0				
Reach 4	Backwater Pool (BWP)	3.0	2.0	76.0	0.0	4.0	2.0
Reach 4	Lateral Scour Pool (LSP)	1.0	1.0	53.3	1.0	3.0	2.3
Reach 4	Lateral Scour Pool – Root Wad Enhanced (LSR)	3.0	2.5	95.0	0.0	4.0	2.0
Reach 4	Mid-Channel Pool (MCP)	1.6	1.8	61.6	0.9	3.1	2.0
Reach 4	Run (RUN)	1.1	1.2	60.5	1.2	2.8	1.9
Reach 5	Lateral Scour Pool – Log Enhanced (LSL)	2.0	1.0	68.0	0.0	4.0	3.0
Reach 5	Mid-Channel Pool (MCP)	1.8	1.0	61.0	1.4	2.6	1.8
Reach 5	Run (RUN)	1.3	0.8	52.4	1.0	3.0	1.5
Reach 5	Secondary Channel Pool (SCP)	1.0	1.0		0.0	4.0	1.0
Reach 6	Low Gradient Riffle (LGR)	3.0	4.0				
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	3.0	4.0	95.0	0.0	4.0	3.0
Reach 6	Mid-Channel Pool (MCP)	1.5	1.0	68.8	2.5	1.5	2.5
Reach 6	Run (RUN)	1.5	1.0	48.0	3.0	1.0	2.0
Reach 7	Dammed Pool (DPL)	3.0	3.0	62.0	2.0	2.0	3.0
Reach 7	Mid-Channel Pool (MCP)	2.2	1.2	67.0	2.4	1.6	3.8
Reach 7	Run (RUN)	2.3	1.7	56.0	2.5	1.5	2.3
Reach 8	Backwater Pool (BWP)	2.0	2.0	79.0	0.0	4.0	0.0
Reach 8	Low Gradient Riffle (LGR)	0.6	0.6	62.3	2.8	1.5	2.8
Reach 8	Lateral Scour Pool – Log Enhanced (LSL)	2.0	1.0	90.0	0.0	4.0	2.0
Reach 8	Lateral Scour Pool (LSP)	2.0	1.5	73.5	1.0	3.0	2.5

Table 3-9. Habitat Quality Classification Average Scores by Subreach and Habitat Type (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Average of Shelter Complexity (value) [1]	Average of Unit Covered (quartile) [2]	Average of Canopy Cover (percent)	Average of Deciduous (quartile)	Average of Non-Deciduous (quartile)	Average of Vegetation Quality (value) [3]
Reach 8	Lateral Scour Pool – Root Wad Enhanced (LSR)	2.0	1.0	69.0	1.0	3.0	2.0
Reach 8	Mid-Channel Pool (MCP)	2.0	1.5	70.5	1.5	2.6	2.7
Reach 8	Run (RUN)	1.5	1.3	69.0	1.5	2.5	2.5
Reach 9	Mid-Channel Pool (MCP)	3.0	2.0	86.0	2.0	2.0	3.0
Reach 9	Run (RUN)	0.0	0.0				0.0
Reach 10	Mid-Channel Pool (MCP)	1.0	0.8	74.6	0.7	2.7	1.5
Reach 10	Run (RUN)	2.0	2.0	74.0	0.0	4.0	2.0
Reach 11	Backwater Pool (BWP)	1.0	1.0	67.0	3.0	1.0	3.0
Reach 11	Channel Confluence Pool (CCP)	0.0	0.0	0.0			1.0
Reach 11	Low Gradient Riffle (LGR)	2.0	2.0	93.0	0.0	4.0	4.0
Reach 11	Lateral Scour Pool – Log Enhanced (LSL)	3.0	1.5	80.5	2.0	2.0	3.0
Reach 11	Lateral Scour Pool (LSP)	3.0	1.0	63.5	4.0	0.0	4.0
Reach 11	Lateral Scour Pool – Root Wad Enhanced (LSR)	1.0	1.0	97.0	0.0	4.0	3.0
Reach 11	Mid-Channel Pool (MCP)	1.5	1.0	60.2	2.5	1.7	3.2
Reach 11	Run (RUN)	0.7	0.7	52.8	2.0	2.0	3.0
Reach 12	Mid-Channel Pool (MCP)	1.0	1.0	81.0	3.0	1.0	3.0
Reach 13	Mid-Channel Pool (MCP)	1.0	1.0	81.0	3.0	1.0	3.0
Reach 14	Lateral Scour Pool – Root Wad Enhanced (LSR)	3.0	2.0	86.0	2.0	2.0	3.0
Reach 14	Mid-Channel Pool (MCP)	1.3	1.3	69.2	1.9	2.1	2.9
Reach 14	Run (RUN)	0.8	0.9	75.6	1.9	2.1	2.7
Upstream of Reach 14	Backwater Pool (BWP)	2.0	2.0	85.0	3.0	1.0	2.0

Table 3-9. Habitat Quality Classification Average Scores by Subreach and Habitat Type (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Average of Shelter Complexity (value)[1]	Average of Unit Covered (quartile)[2]	Average of Canopy Cover (percent)	Average of Deciduous (quartile)	Average of Non-Deciduous (quartile)	Average of Vegetation Quality (value)[3]
Upstream of Reach 14	Low Gradient Riffle (LGR)	1.0	2.0	77.0	3.0	1.0	2.0
Upstream of Reach 14	Mid-Channel Pool (MCP)	2.3	2.0	74.0	2.0	2.0	3.0
Upstream of Reach 14	Run (RUN)	1.3	1.0	78.3	1.7	2.3	3.7

[1] Shelter complexity values ranged from 0 (no shelter) to 3 (highest value).

[2] Quartile values are: 0 = no cover; 1 = 25 percent; 2 = 26-50 percent; 3 = 51-75 percent; 4 = 76-100 percent.

[3] Quality of vegetation values range from 1 (lowest) to 4 (highest).

Table 3-10. Habitat Quality Averages by Subreach for All Habitat Units.

Stream Reach Subreach	Average of Shelter Complexity (value) [1]	Average of Unit Covered (quartile) [2]	Average of Canopy Cover (percent)	Average of Deciduous (quartile)	Average of Non-Deciduous (quartile)	Average of Vegetation Quality (value) [3]
Downstream of Reach 4	0.5	0.3	59.5	2.5	1.5	3.5
Reach 4	1.4	1.5	63.2	0.9	3.1	2.0
Reach 5	1.5	0.9	57.7	1.0	3.0	1.7
Reach 6	1.9	1.8	69.7	2.2	1.8	2.5
Reach 7	2.3	1.6	63.6	2.4	1.6	3.2
Reach 8	1.7	1.3	69.8	1.5	2.6	2.5
Reach 9	1.5	1.0	86.0	2.0	2.0	1.5
Reach 10	1.1	1.0	74.5	0.6	2.9	1.6
Reach 11	1.5	1.0	62.6	2.1	1.9	3.1
Reach 12	1.0	1.0	81.0	3.0	1.0	3.0
Reach 13	1.0	1.0	81.0	3.0	1.0	3.0
Reach 14	1.2	1.2	72.2	1.9	2.1	2.8
Upstream of Reach 14	1.8	1.6	77.9	2.1	1.9	3.0

[1] Shelter complexity values ranged from 0 (no shelter) to 3 (highest value) for individual units.

[2] Quartile values are: 0 = no cover; 1 = 25 percent; 2 = 26-50 percent; 3 = 51-75 percent; 4 = 76-100 percent.

[3] Quality of vegetation values range from 1 (lowest) to 4 (highest).

Table 3-11. Frequency of Submerged Aquatic Vegetation (Quartiles) by Habitat Type and Subreach.

Stream Reach Subreach	Habitat Unit Type (code)	Submerged Aquatic Vegetation (quartile)	Number of Habitat Units with this Amount of Submerged Aquatic Vegetation
Downstream of Reach 4	Backwater Pool (BWP)	0	1
Downstream of Reach 4	Lateral Scour Pool (LSP)	0	1
Downstream of Reach 4	Mid-Channel Pool (MCP)	0	1
Downstream of Reach 4	Secondary Channel Pool (SCP)	0	1
Reach 4	Backwater Pool (BWP)	0	1
Reach 4	Lateral Scour Pool (LSP)	0	4
Reach 4	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	2
Reach 4	Mid-Channel Pool (MCP)	0	6
Reach 4	Mid-Channel Pool (MCP)	1	1
Reach 4	Mid-Channel Pool (MCP)	3	1
Reach 4	Run (RUN)	0	11
Reach 4	Run (RUN)	1	1
Reach 4	Run (RUN)	3	1
Reach 5	Lateral Scour Pool – Log Enhanced (LSL)	0	1
Reach 5	Mid-Channel Pool (MCP)	0	4
Reach 5	Mid-Channel Pool (MCP)	1	1
Reach 5	Run (RUN)	0	5
Reach 5	Run (RUN)	1	1
Reach 5	Secondary Channel Pool (SCP)	0	1
Reach 6	Low Gradient Riffle (LGR)	0	1
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	1
Reach 6	Mid-Channel Pool (MCP)	0	4
Reach 6	Run (RUN)	0	2
Reach 7	Dammed Pool (DPL)	0	1
Reach 7	Mid-Channel Pool (MCP)	0	5
Reach 7	Run (RUN)	0	3
Reach 8	Backwater Pool (BWP)	0	1
Reach 8	Low Gradient Riffle (LGR)	0	5
Reach 8	Lateral Scour Pool – Log Enhanced (LSL)	0	1
Reach 8	Lateral Scour Pool (LSP)	0	2
Reach 8	Lateral Scour Pool – Root Wad Enhanced (LSR)	1	1
Reach 8	Mid-Channel Pool (MCP)	0	19
Reach 8	Mid-Channel Pool (MCP)	1	3
Reach 8	Run (RUN)	0	24

Table 3-11. Frequency of Submerged Aquatic Vegetation (Quartiles) by Habitat Type and Subreach (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Submerged Aquatic Vegetation (quartile)	Number of Habitat Units with this Amount of Submerged Aquatic Vegetation
Reach 8	Run (RUN)	1	2
Reach 9	Mid-Channel Pool (MCP)	0	1
Reach 9	Run (RUN)	0	1
Reach 10	Mid-Channel Pool (MCP)	0	6
Reach 10	Run (RUN)	0	1
Reach 11	Backwater Pool (BWP)	0	1
Reach 11	Channel Confluence Pool (CCP)	0	1
Reach 11	Low Gradient Riffle (LGR)	0	1
Reach 11	Lateral Scour Pool – Log Enhanced (LSL)	0	2
Reach 11	Lateral Scour Pool (LSP)	0	1
Reach 11	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	1
Reach 11	Mid-Channel Pool (MCP)	0	6
Reach 11	Run (RUN)	0	3
Reach 12	Mid-Channel Pool (MCP)	0	1
Reach 13	Mid-Channel Pool (MCP)	0	1
Reach 14	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	1
Reach 14	Mid-Channel Pool (MCP)	0	15
Reach 14	Run (RUN)	0	10
Upstream of Reach 14	Backwater Pool (BWP)	0	1
Upstream of Reach 14	Low Gradient Riffle (LGR)	0	1
Upstream of Reach 14	Mid-Channel Pool (MCP)	0	3
Upstream of Reach 14	Run (RUN)	0	3

Table 3-12. Frequency of Floating Aquatic Vegetation (Quartiles) by Habitat Type and Subreach.

Stream Reach Subreach	Habitat Unit Type (code)	Floating Aquatic Vegetation (quartile)	Number of Habitat Units with this Amount of Floating Aquatic Vegetation
Downstream of Reach 4	Backwater Pool (BWP)	0	1
Downstream of Reach 4	Lateral Scour Pool (Lateral Scour Pool (LSP))	0	1
Downstream of Reach 4	Mid-Channel Pool (MCP)	0	1
Downstream of Reach 4	Secondary Channel Pool (SCP)	0	1
Reach 4	Backwater Pool (BWP)	0	1
Reach 4	Lateral Scour Pool (Lateral Scour Pool (LSP))	0	4
Reach 4	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	2
Reach 4	Mid-Channel Pool (MCP)	0	7
Reach 4	Mid-Channel Pool (MCP)	3	1
Reach 4	Run (RUN)	0	11
Reach 4	Run (RUN)	1	1
Reach 4	Run (RUN)	3	1
Reach 5	Lateral Scour Pool – Log Enhanced (LSL)	0	1
Reach 5	Mid-Channel Pool (MCP)	0	5
Reach 5	Run (RUN)	0	5
Reach 5	Run (RUN)	1	1
Reach 5	Secondary Channel Pool (SCP)	0	1
Reach 6	Low Gradient Riffle (LGR)	0	1
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	1
Reach 6	Mid-Channel Pool (MCP)	0	4
Reach 6	Run (RUN)	0	2
Reach 7	Dammed Pool (DPL)	0	1
Reach 7	Mid-Channel Pool (MCP)	0	5
Reach 7	Run (RUN)	0	3
Reach 8	Backwater Pool (BWP)	0	1
Reach 8	Low Gradient Riffle (LGR)	0	4
Reach 8	Low Gradient Riffle (LGR)	1	1
Reach 8	Lateral Scour Pool – Log Enhanced (LSL)	0	1
Reach 8	Lateral Scour Pool (LSP)	0	2
Reach 8	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	1
Reach 8	Mid-Channel Pool (MCP)	0	22
Reach 8	Run (RUN)	0	26

Table 3-12. Frequency of Floating Aquatic Vegetation (Quartiles) by Habitat Type and Subreach (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Floating Aquatic Vegetation (quartile)	Number of Habitat Units with this Amount of Floating Aquatic Vegetation
Reach 9	Mid-Channel Pool (MCP)	0	1
Reach 9	Run (RUN)	0	1
Reach 10	Mid-Channel Pool (MCP)	0	6
Reach 10	Run (RUN)	0	1
Reach 11	Backwater Pool (BWP)	0	1
Reach 11	Channel Confluence Pool (CCP)	0	1
Reach 11	Low Gradient Riffle (LGR)	0	1
Reach 11	Lateral Scour Pool – Log Enhanced (LSL)	0	2
Reach 11	Lateral Scour Pool (Lateral Scour Pool (LSP))	0	1
Reach 11	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	1
Reach 11	Mid-Channel Pool (MCP)	0	6
Reach 11	Run (RUN)	0	2
Reach 11	Run (RUN)	1	1
Reach 12	Mid-Channel Pool (MCP)	0	1
Reach 13	Mid-Channel Pool (MCP)	0	1
Reach 14	Lateral Scour Pool – Root Wad Enhanced (LSR)	0	1
Reach 14	Mid-Channel Pool (MCP)	0	15
Reach 14	Run (RUN)	0	10
Upstream of Reach 14	Backwater Pool (BWP)	0	1
Upstream of Reach 14	Low Gradient Riffle (LGR)	0	1
Upstream of Reach 14	Mid-Channel Pool (MCP)	0	3
Upstream of Reach 14	Run (RUN)	0	3

APPENDIX A

FIELD PROTOCOL

HABITAT TYPING

Aquatic habitat will be assessed in Coyote Creek from approximately 500 feet upstream of Montague Expressway to approximately 500 feet downstream of Interstate 280. Subreaches are defined as follows.

Reach 4	Montague Expressway to Charcot Ave
Reach 5	Charcot Ave to Interstate 880
Reach 6	Interstate 880 to Ridder Park Dr
Reach 7	Ridder Park Dr to Old Oakland Rd
Reach 8	Old Oakland Rd to Berryessa Rd
Reach 9	Berryessa Rd to Mabury Rd
Reach 10	Mabury Rd to Highway 101
Reach 11	Highway 101 to E. Julian St
Reach 12	E Julian St to E Santa Clara St
Reach 13	E Santa Clara St to E William St
Reach 14	E William St to Interstate 280

1. Daily Discharge Measurement

A discharge measurement will be taken daily prior to habitat typing. The flow transect will be located at a fixed location selected prior to habitat survey commencement for that reach. The flow transect location will be located in an area that is both easy to access by road and allows for accurate flow measurement (i.e. laminar flow, run type habitat, etc.). The location will be mapped on the map and a GPS coordinate obtained (if possible).

The flow measurement location will coincide with major tributaries flowing into Coyote Creek. The stream flow measurement location will remain near Montague Expressway until habitat typing is conduced above the confluence of Upper Penitencia Creek. At this time a new location will be selected just above the confluence. When Lower Silver Creek is encountered, a new location will be selected just above the confluence of that creek. Because the extent of habitat typing will be downstream of Interstate 280, this will be last major tributary encountered.

2. Habitat Delineation

Habitat units will be delineated using a modified protocol of the aquatic habitat classification system from the California Salmonid Stream Habitat Restoration Manual (1998), as follows:

- Habitat units will be characterized as riffle (low gradient <2%, medium gradient >2-4%), run, and pool (mid-channel, LWD or rootwad formed pool, lateral scour, backwater pool) type habitats (Table 1).

Table 1. Habitat Types and Codes (adapted from Flosi et al. 1998).

Code	Habitat Type	Description
LGR	Low gradient riffle	Shallow reaches with swiftly flowing, turbulent water with some partially exposed substrate. Gradient <2 %. Substrate usually cobble dominated.
MGR	Medium gradient riffle	Shallow reaches with swiftly flowing, turbulent water with some partially exposed substrate. Gradient >2 to 4 %. Substrate usually cobble dominated.
RUN	Run	Swiftly flowing reaches with little surface agitation and no major flow obstructions. Often appears as flooded riffles. Typical substrate consists of gravel, cobble and boulders.
MCP	Mid-channel pool	Large pools formed by mid-channel scour. The sour hole encompasses more than 60% of the wetted channel. Water velocity is slow, and the substrate is highly variable.
LSL	Lateral scour pool – log enhanced (large woody debris	Formed by flow impinging against a partial channel obstruction consisting of large woody debris. The associated scour is generally confined to <60% of the wetted channel width.
LSR	Lateral scour pool – root wad enhanced	Formed by flow impinging against a partial channel obstruction consisting of a root wad. The associated scour is generally confined to <60% of the wetted channel width.
LSP	Lateral scour pool	Formed by flow impinging against a partial channel obstruction. The associated scour is generally confined to <60% of the wetted channel width.
BWP	Backwater pool	Found along channel margins and caused by eddies around an obstruction. These pools are usually shallow and are dominated by fine-grained substrate. Current velocities are quite low.
DPL	Dammed pools	Water impounded from a complete or nearly complete channel blockage (log debris jams, rock landslides or dams). Substrate tends to be dominated by smaller gravel and sand.

- The location of each riffle, run, and pool will be marked on the aerial photographs (which will be provided by the District with river mile notations) by marking the upstream and downstream extent of each habitat. The location of spawning gravels (discussed later) and habitat units later will be marked electronically by ENTRIX GIS staff on orthorectified maps provided by the District.

- The length of each habitat unit will be measured to the nearest 1-foot.
- The mean and maximum width and depth of each habitat unit will be measured to the nearest 0.1-foot.
- Pool tail outs will be split out as a run habitat and labeled as both.
- If additional habitat types are encountered, they will be noted consistent with Flosi et al. 1998.
- Habitat inventory data will be collected working upstream (as feasible). Right and left banks will be designated facing in an upstream direction.
- Field data sheets will be QA/QC checked as each sheet is completed.
- Landmarks will be noted to enable the District to easily locate habitat units. In stream reaches where landmarks are not available, tree tags will be attached, if possible, and noted in field books. GPS coordinates will be taken where feasible.

3. Instream Habitat

Instream habitat will be evaluated for each habitat unit. Both the cover complexity and the amount of cover will be evaluated.

Cover Complexity

The CDFG numerical rating system for instream shelter complexity will be assessed for each habitat unit. The CDFG numerical rating system is as follows (Table 2):

Table 2. Cover Complexity Values.

Value	Description
0	No shelter
1	• One to five boulders; • Bare undercut bank; • Single piece of large wood (12" in diameter and 6' long) defined as large woody debris (LWD).
2	• One or two pieces of LWD associated with any amount of small wood (<12" diameter) defined as small woody debris (SWD); • Six or more boulders per 50 feet; Stable undercut bank with root mass, and less than 12" undercut; • A single root wad lacking complexity; • Branches in or near the water; • Limited submersed vegetative fish cover; • Bubble curtain.
3	**Combinations of (must have at least two cover types):** • LWD/boulders/root wads; Three or more pieces of LWD combined with SWD; • Three or more boulders combined with LWD/SWD; • Bubble curtain combined with LWD or boulders; • Stable undercut bank with > than 12" undercut, associated with root mass or LWD; • Extensive submersed vegetative fish cover.

Cover Amount

The percent (in quartiles) of occupied area of instream complexity for each habitat unit will also be assessed. The instream complexity (in quartiles) of occupied area of instream complexity will be described as follows:

0 – No cover.
1 – 1 to 25 percent.
2 – 26 to 50 percent
3 – 51 to 75 percent
4 – 76 to 100 percent

Along with an estimate of instream vegetation, a description and visual estimate of the percent of the type of cover will be noted on the data sheet (i.e. floating or submerged aquatic vegetation.

4. Vegetation Evaluation

The amount, type, and quality of vegetation for each habitat unit will be evaluated.

Amount and Type of Vegetation

- Canopy cover will be measured with a spherical densiometer to determine the mean percent of the habitat unit that is shaded by overhanging vegetation for the habitat unit.
- The type of vegetation will be recorded as deciduous or non-deciduous. A visual estimate will be made of the percent of each, in quartiles.

The densiometer is utilized while standing in the middle of the habitat type area and in the center of the stream facing downstream. The number of points surrounded by vegetation are counted when measuring canopy closure. Measurements are taken in the four quadrants while standing on the same point (facing downstream, right bank, upstream, left bank).

Each point has a value of 1.5 percent when four different recordings are made. The points counted for each reading are totaled and multiplied by 1.5 to obtain the percentage of canopy closure. If all possible observation points are counted the total value will be 102 percent (68 x 1.5 – 102). Although this error is small and not considered important for comparisons of relative values, the following correction factor will be applied to determine the correct percentile:

Calculated value	Subtract from Calculated Value
Less than 30	0
30 to 60	-1
over 60	-2

Quality of Vegetation

The quality of vegetation for each habitat unit will be rated as follows (Table 3):

Table 3. Quality of Vegetation Codes.

Value	Description
1	Trees are rare or absent, and shrub cover is sparse and clumped. Growth and reproduction vigor is generally poor. Root mass is likely to be discontinuous and shallow.
2	Lack of vigor is evident in some individuals or species. Tree seedling reproduction is minimal. Much of the segment lacks vegetation and the potential for a deep root mass. Serious erosion is likely at high streamflows.
3	Openings in the tree canopy are larger than the space resulting from the loss of a single mature individual. Although plant growth appears good, few or no large and old trees and shrubs are present. A deep root mass may not seem continuous, and significant erosion is possible in the openings during high stream flows.
4	Combined cover of trees, shrubs, grass and forbs is very dense on the banks of each individual habitat unit. Openings in canopy cover are small and dispersed. Many plant species and age classes are represented. Growth is vigorous and the age or size of the structure of plants suggests continued ground cover. A deep, dense root mass is likely.

5. Spawning Gravel

Spawning gravel will be assessed for each habitat unit as follows:

- Rounded, coarse gravels 1 to 13 cm in diameter[1], which are located in the tail of a pool or riffle and maintain a contiguous spawning gravel area of 1 m^2, will be recognized as potential spawning locations.
- Spawning locations will be noted on aerial maps (provided by the District), data will be noted on spawning gravel data sheets, and the GPS coordinates will be recorded (if available). Reach and habitat unit numbers will be recorded on data sheets.
- Length and width spawning gravel will be recorded on the data sheet.
- Spawning gravel will be noted if it is in the wetted channel or in the high-flow channel (which may be available during the anadromous fish spawning season).
- Although habitat typing will not be conducted in stream reaches that are dry, these reaches will be surveyed on foot, if accessible, to note the location of spawning gravel.

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[1] Angular gravels are generally considered not suitable for salmonid spawning.

PHOTO DOCUMENTATION

Photos will be taken of representative habitats (and any unusual features) in each subreach. When taking photos make sure to provide a sense of scale in the picture using a stadia rod, a person, or some other object of known size.

Photos will be recorded on the habitat data sheet with the date and individual picture number. Corresponding to the record on the data sheet will be descriptive photo-documentation in a photo log (dedicated field notebook). The following information will be included in the photo log.

- Date
- Time
- Picture number
- Subreach name
- Habitat unit number
- Description of photo (including reason the photo was taken)

At the beginning of each day, a photo will be taken of a slate that contains the following information:

Coyote Creek Habitat Survey
Subreach name
Date

PASSAGE BARRIERS

The Scope of Work for this project does not include evaluation of passage barriers. However, if passage barriers are observed, a note will be made in the field notebook of the type of barrier and the location (habitat unit number, GPS if available). A photo may be taken if needed.

EQUIPMENT CHECKLIST

For Vehicle
Access key
Access maps
City maps
Aerial photo set (on waterproof paper)
Ice chest
Vehicle ID placard
Health and Safety Plan
Work plan

Team Equipment
Marsh-McBirney flow meter/topset rod
Stadia rod
Echo sounder (handheld) or marked sounding line.
Range finder
100 m-tape
Helping hands
Small ruler (mm)
Densiometer
Float-tube or small pontoon boat
Hip chain and hip chain string
Camera (digital)
Thermometer (°C) - 2
Flagging tape
Hammer/nails/tree tags
GPS (with extra batteries)
Log books (1 photo, 1 field notes)
Field data sheets:
- Habitat inventory
- Spawning gravel
- Flow data

Clipboard
Pencils, erasers, sharpies
Field protocol
Habitat typing reference guide (CDFG pages)

Safety
Phone
Phone list
First aid kits
Technu armour and cleanser
Mosquito repellent
Halt
Anti-bacterial sanitizer
Flotation devices for deep water

Personal Equipment
Polarized sunglasses
Chest waders and wading shoes
Sunscreen
Backpack (at least one water proof case for instruments)
Watch
Drinking water
Lunch
Aquaseal

APPENDIX B

HABITAT DATA BY REACH AND HABITAT UNIT

Appendix B. Habitat Data by Unit.

Stream Reach Subreach	Habitat Unit Type (code)	Side Channel	Presence or Absence of Gravel [1]	Unit Length (ft)	Unit Mean Width (ft)	Unit Mean Depth (ft)	Unit Maximum Depth (ft)	Shelter Complexity (value) [2]	Unit Covered (quartile) [3]	Floating Aquatic Vegetation (quartile)	Submerged Aquatic Vegetation (quartile)	Canopy Cover (percent)	Deciduous (quartile)	Non-Deciduous (quartile)	Vegetation Quality (value) [4]
Downstream of Reach 4	Lateral Scour Pool (LSP)		A	133.7	25.9	1.0	1.5	0	0	0	0				
Downstream of Reach 4	Secondary Channel Pool (SCP)	1	A	133.7	9.0	0.9	1.0	0	0	0	0				
Downstream of Reach 4	Mid-Channel Pool (MCP)		A	500.0	23.9	1.5	2.4	2	1	0	0	57	1	3	3
Downstream of Reach 4	Backwater Pool (BWP)	1	A	39.0	17.1	1.5	1.7	0	0	0	0	62	4	0	4
Reach 4	Lateral Scour Pool (LSP)		P	59.5	14.3	1.4	2.2	0	0	0	0				
Reach 4	Run (RUN)		P	21.4	12.4	0.6	1.4	1	1	1	1	17	4	0	1
Reach 4	Mid-Channel Pool (MCP)		A	82.8	20.9	1.6	2.4	1	1	0	0	82	0	4	1
Reach 4	Run (RUN)		A	79.5	16.0	1.0	1.4	2	2	0	0	62	0	4	2
Reach 4	Mid-Channel Pool (MCP)		A	69.0	23.2	2.4	4.6	1	1	0	0	55	2	2	2
Reach 4	Run (RUN)		A	71.5	17.3	1.0	1.9	1	1	0	0	70	0	4	1
Reach 4	Mid-Channel Pool (MCP)		A	125.7	17.3	1.7	3.6	2	2	0	0	77	1	3	2
Reach 4	Run (RUN)		A	22.9	13.3	1.2	1.8	0	0	0	0	81	1	3	2
Reach 4	Mid-Channel Pool (MCP)		A	28.3	18.8	1.6	2.3	2	1	0	0	90	1	3	3
Reach 4	Mid-Channel Pool (MCP)		A	126.0	19.0	2.5	4.2	2	2	0	1	63	1	3	2
Reach 4	Run (RUN)		A	124.6	22.7	0.9	2.0	2	2	0	0	59	1	3	3
Reach 4	Lateral Scour Pool – Root Wad Enhanced (LSR)		A	66.7	21.0	2.2	4.0	3	2	0	0	100	0	4	2
Reach 4	Run (RUN)		A	25.0	19.0	0.8	1.4	1	1	0	0	92	1	3	2
Reach 4	Lateral Scour Pool (LSP)		A	67.7	21.0	1.8	2.7	1	1	0	0	52	2	2	3
Reach 4	Run (RUN)		A	31.0	21.0	0.7	1.5	1	1	0	0	83	0	4	2
Reach 4	Lateral Scour Pool – Root Wad Enhanced (LSR)		A	80.6	19.7	1.9	3.0	3	3	0	0	90	0	4	2
Reach 4	Lateral Scour Pool (LSP)		A	39.3	19.6	1.0	2.0	1	1	0	0	60	0	4	2
Reach 4	Run (RUN)		A	25.1	19.6	0.7	1.3	0	0	0	0	56	0	4	2
Reach 4	Lateral Scour Pool (LSP)		A	133.8	25.1	2.7	3.7	2	2	0	0	48	1	3	2
Reach 4	Run (RUN)		P	28.2	21.3	0.6	1.0	1	1	0	0	55	3	1	3
Reach 4	Run (RUN)		A	50.6	17.0	0.9	1.3	2	2	0	0	42	0	4	2
Reach 4	Backwater Pool (BWP)		A	64.8	16.6	1.5	2.0	3	2	0	0	76	0	4	2
Reach 4	Run (RUN)		A	40.0	20.7	0.9	1.2	1	1	0	0	84	2	2	2
Reach 4	Mid-Channel Pool (MCP)		P	156.6	21.3	1.8	3.3	2	2	0	0	67	0	4	2
Reach 4	Run (RUN)		A	25.6	22.6	0.7	1.2	1	1	0	0	86	2	2	2
Reach 4	Mid-Channel Pool (MCP)		A	1,876.6	33.3	2.9	6.8	2	2	0	0	59	1	3	3
Reach 4	Mid-Channel Pool (MCP)		A	85.6	30.0	1.3	1.6	1	3	3	3	0			1
Reach 4	Run (RUN)		A	156.1	13.0	1.3	1.6	1	3	3	3	0			1
Reach 5	Run (RUN)		P	307.9	18.0	1.0	1.8	1	1	0	0				1
Reach 5	Secondary Channel Pool (SCP)	1	A	292.9	12.6	0.6	1.0	1	1	0	0		0	4	1
Reach 5	Mid-Channel Pool (MCP)		A	194.7	25.8	2.5	3.4	2	1	0	1	61	3	1	1
Reach 5	Run (RUN)		P	192.9	24.0	1.2	1.6	2	1	0	0	63	2	2	2
Reach 5	Mid-Channel Pool (MCP)		A	184.0	27.0	2.3	3.3	2	1	0	0	58	2	2	2
Reach 5	Run (RUN)		A	61.9	27.0	1.0	1.6	2	1	0	0	58	2	2	2
Reach 5	Mid-Channel Pool (MCP)		A	156.6	25.1	3.0	5.0	2	1	0	0	76	1	3	2

Appendix B. Habitat Data by Unit (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Side Channel	Presence or Absence of Gravel [1]	Unit Length (ft)	Unit Mean Width (ft)	Unit Mean Depth (ft)	Unit Maximum Depth (ft)	Shelter Complexity (value) [2]	Unit Covered (quartile) [3]	Floating Aquatic Vegetation (quartile)	Submerged Aquatic Vegetation (quartile)	Canopy Cover (percent)	Deciduous (quartile)	Non-Deciduous (quartile)	Vegetation Quality (value) [4]
Reach 5	Run (RUN)		P	55.8	10.4	1.1	2.0	2	1	0	0	50	1	3	2
Reach 5	Mid-Channel Pool (MCP)		A	410.2	23.4	2.5	4.0	1	1	0	0	40	1	3	2
Reach 5	Run (RUN)		A	33.7	22.8	0.9	1.3	0	0	0	0	61	0	4	1
Reach 5	Mid-Channel Pool (MCP)		A	61.9	20.4	2.0	2.4	2	1	0	0	70	0	4	2
Reach 5	Run (RUN)		A	85.8	24.7	1.0	1.2	1	1	1	1	30	0	4	1
Reach 5	Lateral Scour Pool – Log Enhanced (LSL)		A	114.9	18.3	2.1	5.0	2	1	0	0	68	0	4	3
Reach 6	Low Gradient Riffle (LGR)		A	27.6	25.2	1.0	1.1	3	4	0	0				
Reach 6	Mid-Channel Pool (MCP)		A	186.3	26.8	3.4	6.2	2	1	0	0	70	2	2	4
Reach 6	Mid-Channel Pool (MCP)		A	546.9	23.5	2.5	6.0	2	1	0	0	62	4	0	2
Reach 6	Run (RUN)		A	59.5	29.3	1.0	1.6	1	1	0	0				
Reach 6	Mid-Channel Pool (MCP)		A	305.2	28.9	3.0	6.2	1	1	0	0	66	2	2	2
Reach 6	Run (RUN)		P	50.4	20.0	0.7	1.3	2	1	0	0	48	3	1	2
Reach 6	Mid-Channel Pool (MCP)		A	125.0	22.7	2.3	3.5	1	1	0	0	77	2	2	2
Reach 6	Lateral Scour Pool – Root Wad Enhanced (LSR)		P	88.1	15.5	5.0	6.0	3	4	0	0	95	0	4	3
Reach 7	Run (RUN)		A	72.0	18.0	0.8	1.3	2	2	0	0				0
Reach 7	Mid-Channel Pool (MCP)		A	188.7	23.0	3.7	6.0	3	1	0	0	71	3	1	4
Reach 7	Run (RUN)		A	92.9	15.0	1.5	2.3	3	2	0	0	52	3	1	4
Reach 7	Mid-Channel Pool (MCP)		A	53.9	17.5	3.5	5.0	2	1	0	0	69	3	1	4
Reach 7	Mid-Channel Pool (MCP)		A	170.9	27.0	2.5	3.7	2	1	0	0	75	2	2	4
Reach 7	Run (RUN)		A	188.7	27.0	0.9	1.4	2	1	0	0	60	2	2	3
Reach 7	Mid-Channel Pool (MCP)		A	320.0	27.0	1.6	3.6	2	1	0	0	60	2	2	3
Reach 7	Dammed Pool (DPL)		A	35.0	31.6	4.0	4.5	3	3	0	0	62	2	2	3
Reach 7	Mid-Channel Pool (MCP)		A	577.0	27.3	3.2	7.0	2	2	0	0	60	2	2	4
Reach 8	Low Gradient Riffle (LGR)		P	124.8	27.4	0.9	2.3	0	0	0	0				
Reach 8	Mid-Channel Pool (MCP)		A	76.5	23.5	1.6	2.6	2	2	0	0	82	1	3	4
Reach 8	Run (RUN)		A	129.0	28.5	1.2	2.6	2	2	0	0	70	1	3	4
Reach 8	Mid-Channel Pool (MCP)		A	125.3	29.5	3.6	5.9	2	2	0	0	83	1	3	4
Reach 8	Run (RUN)		P	68.1	33.0	0.9	2.1	0	0	0	0	64	2	2	4
Reach 8	Low Gradient Riffle (LGR)		P	56.0	38.0	0.6	1.1	1	1	0	0	79	4	1	4
Reach 8	Mid-Channel Pool (MCP)		P	113.3	25.5	2.3	5.0	1	1	0	0	68	2	2	3
Reach 8	Run (RUN)		P	115.7	23.4	0.9	1.4	0	0	0	0	44	1	3	2
Reach 8	Mid-Channel Pool (MCP)		P	129.1	33.6	1.7	2.5	3	2	0	0	53	1	3	4
Reach 8	Run (RUN)		P	385.2	28.2	0.8	1.4	1	1	0	0	36	2	2	2
Reach 8	Mid-Channel Pool (MCP)		P	229.9	32.3	1.8	2.2	3	2	0	0	70	2	2	
Reach 8	Low Gradient Riffle (LGR)		P	36.9	39.0	0.2	1.4	1	1	1	0	42	3	1	3
Reach 8	Run (RUN)		P	132.1	23.9	1.5	2.0	2	2	0	0	58	1	3	3
Reach 8	Lateral Scour Pool (LSP)		A	147.3	33.4	2.6	5.2	3	2	0	0	92	2	2	3
Reach 8	Run (RUN)		P	101.9	38.5	1.2	2.1	1	1	0	0	35	1	4	4
Reach 8	Mid-Channel Pool (MCP)		P	103.6	32.5	2.1	3.0	2	1	0	0	52	1	3	3

Appendix B. Habitat Data by Unit (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Side Channel	Presence or Absence of Gravel [1]	Unit Length (ft)	Unit Mean Width (ft)	Unit Mean Depth (ft)	Unit Maximum Depth (ft)	Shelter Complexity (value) [2]	Unit Covered (quartile) [3]	Floating Aquatic Vegetation (quartile)	Submerged Aquatic Vegetation (quartile)	Canopy Cover (percent)	Deciduous (quartile)	Non-Deciduous (quartile)	Vegetation Quality (value) [4]
Reach 8	Run (RUN)		P	80.1	29.7	0.6	1.4	2	2	0	0	63	2	2	3
Reach 8	Mid-Channel Pool (MCP)		A	139.9	30.9	2.6	4.2	2	1	0	0	78	1	4	3
Reach 8	Run (RUN)		P	46.9	27.0	1.2	2.4	1	1	0	0	48	3	1	3
Reach 8	Low Gradient Riffle (LGR)		P	48.6	27.0	0.5	1.5	1	1	0	0	45	4	0	3
Reach 8	Run (RUN)		P	31.2	27.0	1.3	2.2	1	1	0	0	94	3	1	3
Reach 8	Mid-Channel Pool (MCP)		P	159.4	27.0	1.8	3.0	2	1	0	0	71	3	1	2
Reach 8	Run (RUN)		P	133.9	17.4	0.9	2.0	2	1	0	0	92	1	3	2
Reach 8	Lateral Scour Pool – Log Enhanced (LSL)		A	48.3	18.5	2.5	4.2	2	1	0	0	90	0	4	2
Reach 8	Run (RUN)		P	45.8	15.0	1.0	2.0	2	2	0	0	78	3	1	1
Reach 8	Mid-Channel Pool (MCP)		P	81.2	18.2	2.1	3.0	2	1	0	0	59	1	3	2
Reach 8	Backwater Pool (BWP)	1	P	29.8	17.3	2.0	2.1	2	2	0	0	79	0	4	0
Reach 8	Mid-Channel Pool (MCP)		A	33.1	20.4	1.5	2.1	2	2	0	0	50	1	3	1
Reach 8	Run (RUN)		P	115.2	20.8	0.9	1.5	2	1	0	0	63	2	2	2
Reach 8	Mid-Channel Pool (MCP)		A	224.3	26.6	1.8	3.3	2	1	0	0	62	3	1	3
Reach 8	Run (RUN)		P	185.8	22.7	0.9	1.4	2	1	0	0	75	1	3	2
Reach 8	Mid-Channel Pool (MCP)		A	154.5	28.7	1.8	2.6	2	1	0	0	51	2	2	2
Reach 8	Run (RUN)		P	153.8	25.1	0.9	1.8	1	1	0	0	61	2	2	3
Reach 8	Mid-Channel Pool (MCP)		A	69.1	22.2	4.0	5.0	2	1	0	0	80	1	4	3
Reach 8	Run (RUN)		P	138.8	20.2	1.5	1.8	2	1	0	0	67	2	2	2
Reach 8	Mid-Channel Pool (MCP)		A	73.4	18.5	1.5	3.0	2	1	0	0	69	0	4	3
Reach 8	Run (RUN)		P	170.1	21.5	1.0	1.5	2	1	0	0	62	2	2	2
Reach 8	Lateral Scour Pool (LSP)		A	73.6	24.6	1.5	2.0	1	1	0	0	55	0	4	2
Reach 8	Run (RUN)		P	96.1	25.0	1.0	1.9	1	1	0	0	83	1	3	3
Reach 8	Low Gradient Riffle (LGR)		P	15.0	16.0	0.6	0.7	0	0	0	0	83	0	4	1
Reach 8	Run (RUN)		P	94.6	13.4	1.1	1.7	0	0	0	0	89	0	4	2
Reach 8	Mid-Channel Pool (MCP)		P	67.9	22.0	1.6	2.0	1	1	0	0	66	1	3	4
Reach 8	Run (RUN)		P	18.5	18.9	0.9	1.2	1	1	0	0	69	0	4	3
Reach 8	Mid-Channel Pool (MCP)		A	125.7	19.0		5.0	2	2	0	0	84	3	1	3
Reach 8	Run (RUN)		P	43.3	16.5	0.8	1.4	2	1	0	0	87	0	4	2
Reach 8	Mid-Channel Pool (MCP)		A	42.0	17.6	2.5	3.6	1	1	0	0	86	1	3	2
Reach 8	Run (RUN)		P	18.8	16.4	1.1	1.5	2	2	0	0	74	2	2	1
Reach 8	Mid-Channel Pool (MCP)		A	382.6	17.3		5.0	3	3	0	0	84	1	3	2
Reach 8	Run (RUN)		P	88.6	10.5	1.4	2.7	3	3	0	0	75	1	4	2
Reach 8	Mid-Channel Pool (MCP)	1	A	41.4	16.0	2.0	2.7	1	1	0	0	69	0	4	1
Reach 8	Run (RUN)	1	P	85.0	7.5	0.6	2.0	2	4	0	0	86	0	4	2
Reach 8	Mid-Channel Pool (MCP)		A	38.3	10.2	2.6	3.3	3	2	0	1	78	2	2	3
Reach 8	Run (RUN)		P	26.0	7.8	0.9	1.4	1	1	0	1	84	1	3	3
Reach 8	Mid-Channel Pool (MCP)		A	44.8	17.0	2.5	4.0	2	1	0	1	71	3	1	2
Reach 8	Run (RUN)		P	17.0	13.0	0.8	1.0	2	1	0	1	71	4	0	2

Appendix B. Habitat Data by Unit (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Side Channel	Presence or Absence of Gravel [1]	Unit Length (ft)	Unit Mean Width (ft)	Unit Mean Depth (ft)	Unit Maximum Depth (ft)	Shelter Complexity (value) [2]	Unit Covered (quartile) [3]	Floating Aquatic Vegetation (quartile)	Submerged Aquatic Vegetation (quartile)	Canopy Cover (percent)	Deciduous (quartile)	Non-Deciduous (quartile)	Vegetation Quality (value) [4]
Reach 8	Lateral Scour Pool – Root Wad Enhanced (LSR)		A	32.6	13.0	1.8	3.7	2	1	0	1	69	1	3	2
Reach 8	Run (RUN)		P	72.9	17.5	0.9	1.4	1	1	0	0	66	2	2	3
Reach 8	Mid-Channel Pool (MCP)		A	673.5	17.0	3.8	5.0	3	2	0	1	84	1	3	2
Reach 9	Mid-Channel Pool (MCP)		A	2,293.8	40.0	5.0	8.6	3	2	0	0	86	2	2	3
Reach 9	Run (RUN)		P	60.1	28.7	1.1	1.8	0	0	0	0				0
Reach 10	Mid-Channel Pool (MCP)		P	177.6	23.8	1.4	2.2	0	0	0	0		0	0	0
Reach 10	Run (RUN)		P	22.0	12.1	0.8	1.2	2	2	0	0	74	0	4	2
Reach 10	Mid-Channel Pool (MCP)		A	119.1	45.0	4.4	6.2	1	1	0	0	21	0	4	0
Reach 10	Mid-Channel Pool (MCP)		A	141.9	26.3	3.2	4.2	1	1	0	0	86	1	3	2
Reach 10	Mid-Channel Pool (MCP)		A	47.4	22.8	1.7	2.4	0	0	0	0	89	0	4	1
Reach 10	Mid-Channel Pool (MCP)		A	115.6	27.5	2.8	3.8	2	2	0	0	93	0	4	3
Reach 10	Mid-Channel Pool (MCP)		A	807.0		3.4	8.0	2	1	0	0	84	3	1	3
Reach 11	Run (RUN)		A	33.0	18.6	0.8	1.7	1	1	0	0	76.3	0	4	3
Reach 11	Lateral Scour Pool – Log Enhanced (LSL)		A	57.8	19.7	1.6	3.0	2	1	0	0	76	3	1	3
Reach 11	Run (RUN)		P	71.3	20.7	0.8	1.6	0	0	0	0	27	4	0	3
Reach 11	Lateral Scour Pool (LSP)		A	171.4	24.6	2.6	4.0	3	1	0	0	63.5	4	0	4
Reach 11	Mid-Channel Pool (MCP)		A	107.7	26.0	5.2	5.9	3	1	0	0	77	4	0	4
Reach 11	Run (RUN)		A	34.3	22.8	0.9	1.6	1	1	1	0	55	2	2	3
Reach 11	Mid-Channel Pool (MCP)		A	410.2	28.0	6.0	7.4	1	1	0	0	90	2	3	3
Reach 11	Lateral Scour Pool – Log Enhanced (LSL)		A	138.8	28.1	2.0	4.0	4	2	0	0	85	1	3	3
Reach 11	Mid-Channel Pool (MCP)		A	93.9	28.0	3.7	5.0	1	1	0	0	68	1	3	2
Reach 11	Low Gradient Riffle (LGR)		P	34.5	11.8	0.9	1.3	2	2	0	0	93	0	4	4
Reach 11	Lateral Scour Pool – Root Wad Enhanced (LSR)		A	32.9	13.8	1.6	2.1	1	1	0	0	97	0	4	3
Reach 11	Mid-Channel Pool (MCP)		A	1,176.1	24.0	3.0	6.8	1	1	0	0	72	3	1	3
Reach 11	Backwater Pool (BWP)		A	101.6	46.9	1.2	2.2	1	1	0	0	67	3	1	3
Reach 11	Mid-Channel Pool (MCP)		A	906.9	24.0	3.4	4.7	2	1	0	0	54	2	2	4
Reach 11	Mid-Channel Pool (MCP)		A	34.3	11.0	1.5	2.0	1	1	0	0	0	3	1	3
Reach 11	Channel Confluence Pool (CCP)		A	22.3	18.0	1.5	2.4	0	0	0	0	0			1
Reach 12	Mid-Channel Pool (MCP)		A	5,752.0	21.4	3.0	6.8	1	1	0	0	81	3	1	3
Reach 13	Mid-Channel Pool (MCP)		A	3,335.1	21.4	2.3	5.2	1	1	0	0	81	3	1	3
Reach 14	Run (RUN)		P	111.8	15.8	0.5	1.2	0	0	0	0				
Reach 14	Mid-Channel Pool (MCP)		A	123.0	15.0	1.5	2.5	3	3	0	0	77	2	2	3
Reach 14	Run (RUN)		A	30.6	11.0	0.6	1.0	0	0	0	0	80	0	4	2
Reach 14	Mid-Channel Pool (MCP)		A	47.5	16.5	1.3	1.9	1	1	0	0	76	0	4	3
Reach 14	Run (RUN)		A	7.8	12.0	0.6	1.0	2	3	0	0	78	0	4	3
Reach 14	Lateral Scour Pool – Root Wad Enhanced (LSR)		A	90.4	11.6	2.0	3.0	3	2	0	0	86	2	2	3

Appendix B. Habitat Data by Unit (continued).

Stream Reach Subreach	Habitat Unit Type (code)	Side Channel	Presence or Absence of Gravel [1]	Unit Length (ft)	Unit Mean Width (ft)	Unit Mean Depth (ft)	Unit Maximum Depth (ft)	Shelter Complexity (value) [2]	Unit Covered (quartile) [3]	Floating Aquatic Vegetation (quartile)	Submerged Aquatic Vegetation (quartile)	Canopy Cover (percent)	Deciduous (quartile)	Non-Deciduous (quartile)	Vegetation Quality (value) [4]
Reach 14	Run (RUN)		A	73.3	14.0	0.7	1.2	1	1	0	0	90	4	0	2
Reach 14	Mid-Channel Pool (MCP)		A	52.0	12.6	1.8	2.7	2	2	0	0	81	1	3	3
Reach 14	Run (RUN)		A	47.3	14.0	0.7	1.3	1	1	0	0	93	1	3	2
Reach 14	Mid-Channel Pool (MCP)		A	31.6	24.0	2.0	2.5	1	1	0	0	84	3	1	2
Reach 14	Run (RUN)		A	18.9	12.0	0.7	1.0	1	1	0	0	85	2	2	2
Reach 14	Mid-Channel Pool (MCP)		A	234.5	13.5	1.8	3.3	1	1	0	0	78	2	2	2
Reach 14	Mid-Channel Pool (MCP)		A	56.6	14.0	1.0	1.6	1	1	0	0	70	1	3	4
Reach 14	Run (RUN)		A	49.3	12.0	0.7	1.4	1	1	0	0	48	2	2	4
Reach 14	Mid-Channel Pool (MCP)		A	184.6	15.0	1.4	2.0	1	1	0	0	60	1	3	3
Reach 14	Mid-Channel Pool (MCP)		A	63.5	16.2	1.4	1.5	1	1	0	0	66	2	2	2
Reach 14	Mid-Channel Pool (MCP)		A	142.8	15.7	1.4	2.1	1	1	0	0	60	3	1	3
Reach 14	Mid-Channel Pool (MCP)		A	231.2	25.0	2.5	3.7	1	1	0	0	93	3	1	3
Reach 14	Run (RUN)		A	49.8	18.4	0.7	1.0	1	1	0	0	55	4	0	2
Reach 14	Mid-Channel Pool (MCP)		A	286.5	27.4	2.0	3.7	1	1	0	0	40	3	1	3
Reach 14	Mid-Channel Pool (MCP)		A	92.9	29.1	1.8	3.6	2	2	0	0	80	1	3	3
Reach 14	Run (RUN)		A	32.6	17.5	0.9	1.4	1	1	0	0	71	2	2	4
Reach 14	Mid-Channel Pool (MCP)		A	124.3	26.7	1.5	2.2	1	1	0	0	56	2	2	3
Reach 14	Mid-Channel Pool (MCP)		A	198.4	28.7	3.0	5.0	1	1	0	0	39	2	2	3
Reach 14	Run (RUN)		A	201.1	13.8	0.6	1.0	0	0	0	0	80	2	2	3
Reach 14	Mid-Channel Pool (MCP)		A	361.2	17.4	1.2	2.0	1	1	0	0	78	3	1	4
Upstream of Reach 14	Mid-Channel Pool (MCP)		A	156.9	23.0	0.8	3.7	1	2	0	0	76	3	1	2
Upstream of Reach 14	Low Gradient Riffle (LGR)		A	11.0	16.0	0.5	1.3	1	2	0	0	77	3	1	2
Upstream of Reach 14	Run (RUN)		P	11.3	11.0	0.9	1.1	1	1	0	0	77	3	1	4
Upstream of Reach 14	Mid-Channel Pool (MCP)		A	318.6	17.6	2.5	3.7	3	2	0	0	72	3	1	3
Upstream of Reach 14	Run (RUN)		P	48.5	12.3	0.6	1.0	2	1	0	0	61	2	2	4
Upstream of Reach 14	Backwater Pool (BWP)	1	A	48.5	14.0	2.0	2.5	2	2	0	0	85	3	1	2
Upstream of Reach 14	Run (RUN)		P	40.8	12.0	0.8	1.1	1	1	0	0	97	0	4	3
Upstream of Reach 14	Mid-Channel Pool (MCP)		A	35.3	10.6	1.2	2.0	3	2	0	0		0	4	4

[1] P = gravel present; A = gravel absent

[2] Shelter complexity values ranged from 0 (no shelter) to 3 (highest value).

[3] Quartile values are: 0 = no cover; 1 = 25 percent; 2 = 26-50 percent; 3 = 51-75 percent; 4 = 76-100 percent.

[4] Quality of vegetation values range from 1 (lowest) to 4 (highest).